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KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA

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NATIONAL DAM INSPECTION PROGRAM. HAMILTON LAKE DAM (NDS ID NUMB--ETC(U)

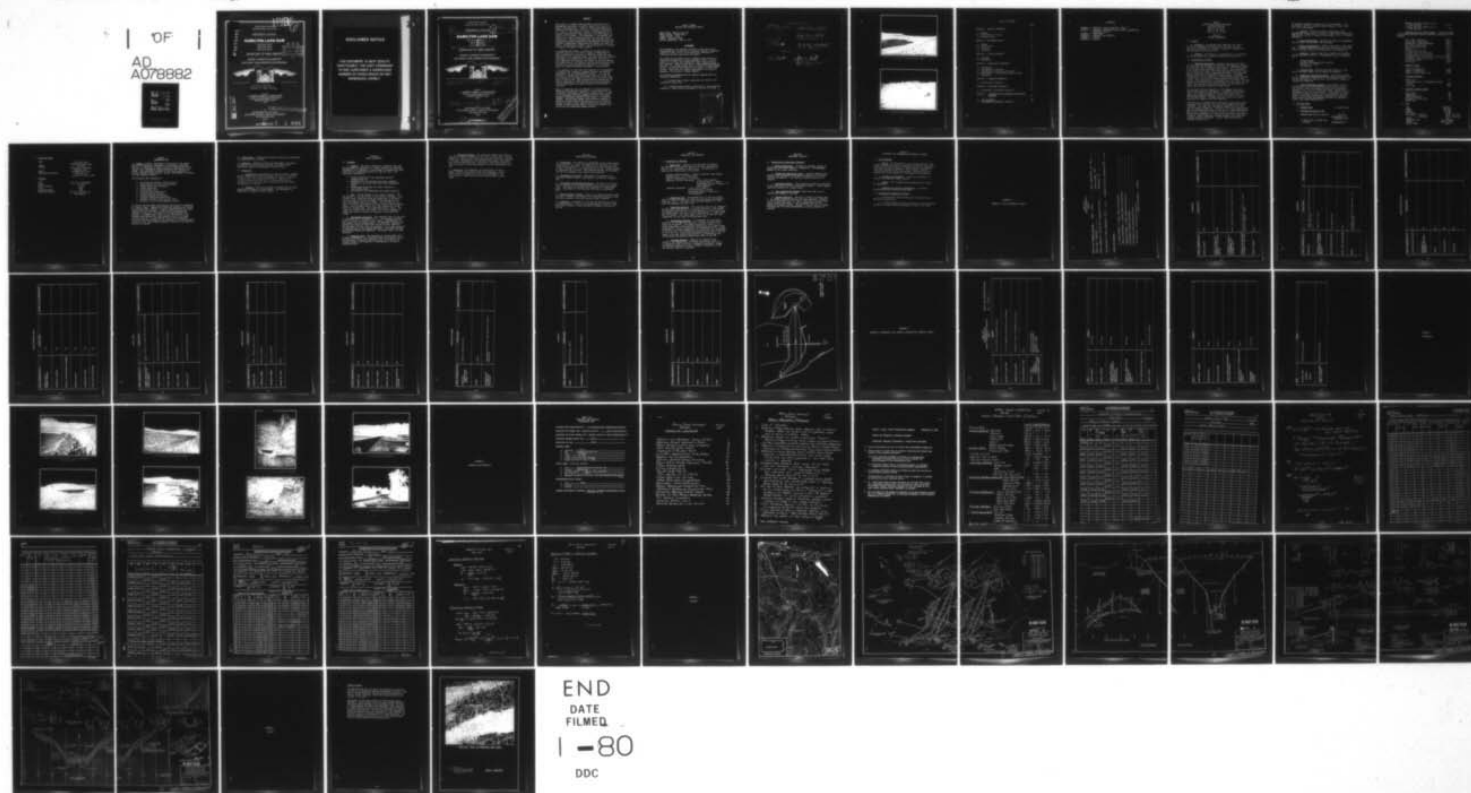
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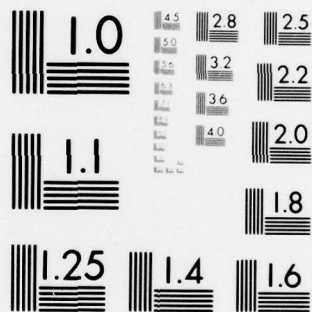
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CHARLESTON CREEK, TIOGA COUNTY

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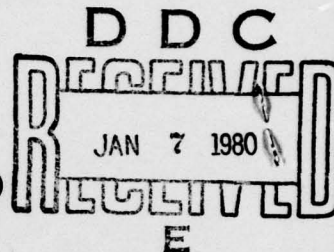
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## HAMILTON LAKE DAM

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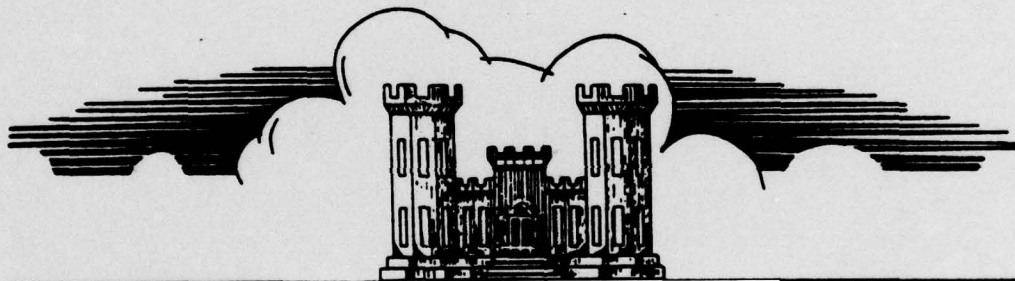
DER ID NO. 59-65

SCS ID NO. PA-602



BOROUGH OF WELLSBORO

### PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



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Prepared By

**L. ROBERT KIMBALL & ASSOCIATES**  
CONSULTING ENGINEERS & ARCHITECTS  
EBENSBURG, PENNSYLVANIA  
15931

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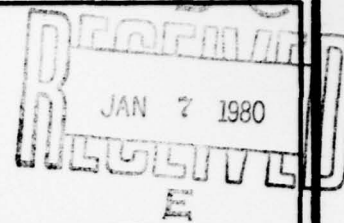
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CHARLESTON CREEK, TIOGA COUNTY



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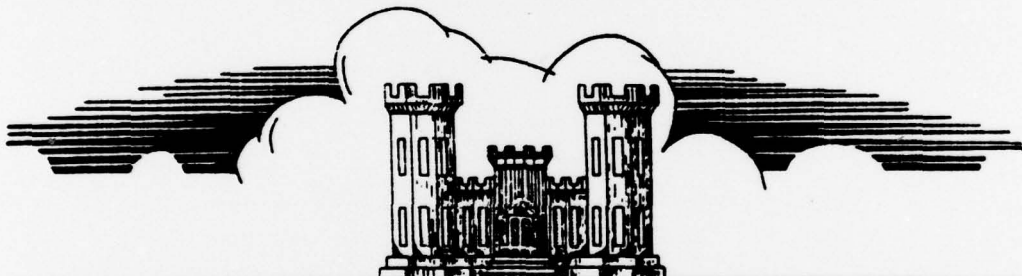
National Dam Inspection Program

# HAMILTON LAKE DAM

(NDS ID NO. PA-33, Number  
DER ID NO. 59-65,  
SCS ID NO. PA-602)

Basin, Charleston Creek, Tioga County,  
BOROUGH OF WELLSBORO, Pennsylvania.

PHASE I INSPECTION REPORT,  
NATIONAL DAM INSPECTION PROGRAM



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Prepared By  
**L. ROBERT KIMBALL & ASSOCIATES**  
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EBENSBURG, PENNSYLVANIA  
15931

10 Kuang-hwei / Chuang R. Jeffrey / Kimball

FOR  
DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT CORPS OF ENGINEERS  
BALTIMORE, MARYLAND  
21203

11 SEPTEMBER 1979

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JOB

## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT  
NATIONAL DAM INSPECTION REPORT

NAME OF DAM: Hamilton Lake Dam  
STATE LOCATED: Pennsylvania  
COUNTY LOCATED: Tioga  
STREAM: Charleston Creek  
DATE OF INSPECTION: (June 28, 1979)

ASSESSMENT

The assessment of the Hamilton Lake Dam is based upon visual observations made at the time of inspection, review of available records and data, review of available data, hydrology and hydrologic and past operational performance.

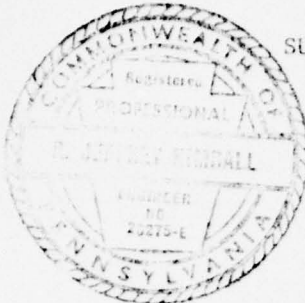
The inspection and review of data of Hamilton Lake Dam did not reveal any problems which require emergency action. The dam appears to be stable, well maintained, safely operated and in good condition. Hamilton Lake Dam is a high hazard-intermediate size dam. The spillway design flood is the PMF (Probable Maximum Flood). The spillway and reservoir are capable of controlling the PMF. Based upon the criteria established by the Corps of Engineers, the spillway is termed adequate.

The following recommendations and remedial measures should be instituted immediately:

- (1) Continue annual safety inspections and operation and maintenance inspections. and
- (2) A warning system should be instituted to warn downstream residents of large spillway discharges or failure of the dam.

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HAMILTON LAKE DAM (PA-33)



SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

*Kuang-hwei Chuang*

Kuang-hwei Chuang, P.E.

SEP 14 1979

Date

*R. Jeffrey Kimball*

R. Jeffrey Kimball, P.E.

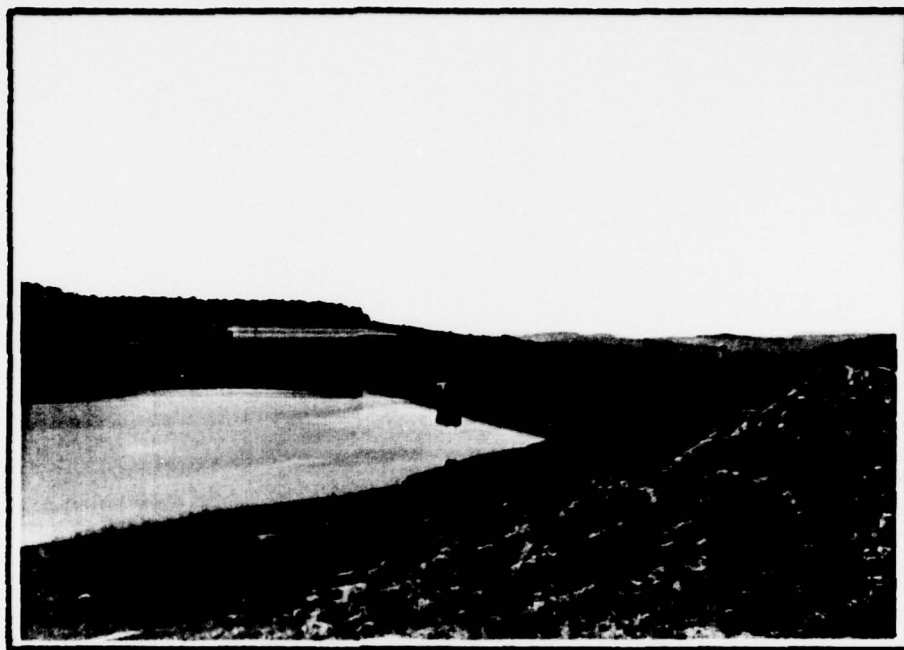
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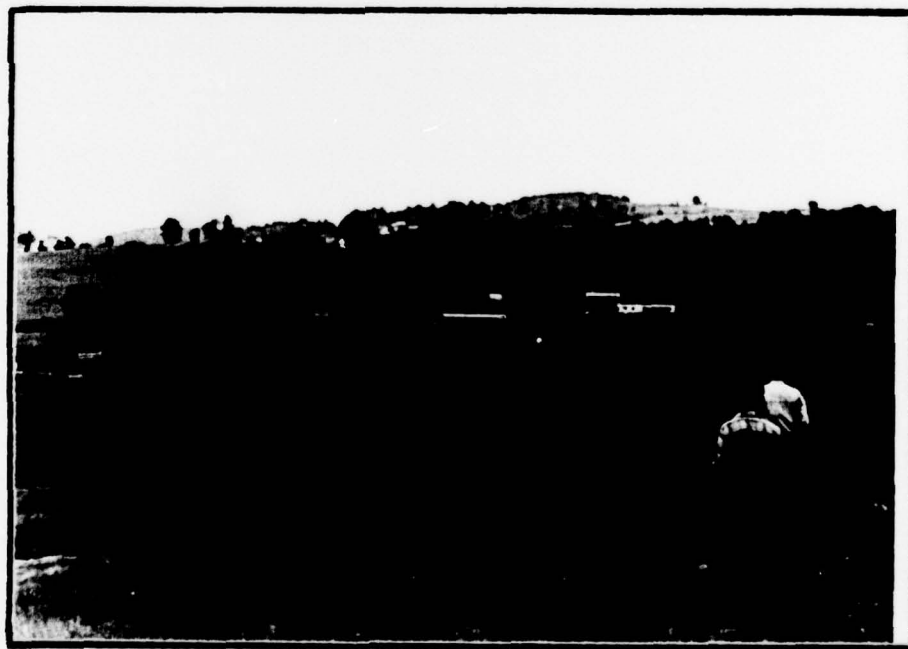
Date

*James W. Peck*

JAMES W. PECK  
Colonel, Corps of Engineers  
District Engineer



Overview of upstream slope of dam.



Overview of downstream slope of dam.

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PHASE I  
NATIONAL DAM INSPECTION PROGRAM  
HAMILTON LAKE DAM  
NDI I.D. NO. PA 33  
DER I.D. NO. 59-65  
SCS I.D. NO. PA 602

SECTION 1  
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary for the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Hamilton Lake Dam is an earth-fill dam 1365 feet long and 76 feet high. The embankment consists of three zones and a foundation cutoff trench. The cutoff trench is of variable depth (maximum 10 feet deep). The bottom width of the trench is 30 feet. The trench and upstream portion of the dam is constructed using an impervious material. The downstream section consists of a foundation drainage system, a drainage blanket and a zone of random fill. The upstream slope of the dam is 3H:1V with a 20 foot wide berm provided at the normal water surface. The upstream face is riprapped below this berm. The downstream slope is 2H:1V with a berm located near the midpoint of the slope. The upstream face above the riprap, the crest and the downstream slope are covered with crown vetch.

The principal spillway consists of a 48" diameter reinforced concrete pipe under the embankment, a reinforced concrete riser unit, a 24" reservoir drain, an outlet control gate, and an impact type energy dissipating concrete structure at the end of the spillway conduit. Concrete anti-seep collars are spaced along the 48" conduit at 22 foot intervals.

The riser unit is constructed of reinforced concrete with inside dimensions of 12 feet by 4 feet and a total height of 58 feet, 10 inches. The riser has a rectangular shaped orifice in one wall for normal stream flow. The top of the riser is constructed with an antivortex device and a trash rack. A reinforced concrete gate well is attached to one side of the riser unit. The well has an inside dimension of 3 feet square and rises to the orifice elevation. Water flows into the well through a 24" reinforced concrete reservoir drainpipe. A slide gate controls water flowing from the well.

The emergency spillway is located on the left abutment. It is an open cut, sodded, trapezoidal shaped channel, 175 feet wide with 3H:1V side slopes.

b. Location. The dam is located on Charleston Creek, approximately 2 miles east of Wellsboro, Tioga County, Pennsylvania. Hamilton Lake Dam can be located on the Antrim, U.S.G.S 7.5 minute quadrangle.

c. Size Classification. Hamilton Lake Dam is an intermediate size structure (76 feet high, 2900 acre-feet).

d. Hazard Classification. Hamilton Lake Dam is a high hazard dam. Downstream conditions indicate that loss of more than a few lives is probable should the structure fail (See Section 3.1e).

e. Ownership. Hamilton Lake Dam is owned by the Wellsboro Borough Municipal Authority. Correspondence should be addressed to:

Borough Manager  
Wellsboro Borough Municipal Authority  
Wellsboro, PA 16901  
717-724-4604

f. Purpose of Dam. Hamilton Lake Dam is used for flood control and water supply for the Borough of Wellsboro.

g. Design and Construction History. The dam was designed by U.S. Department of Agriculture Soil Conservation Service. The dam was constructed in 1966 to 1967. The SCS was in charge of construction inspection.

h. Normal Operating Procedures. The reservoir level is maintained at or near the principal spillway orifice invert. The reservoir drain line remains partially open to maintain a minimum flow of 1.25 cfs on Charleston Creek. Excess inflow discharges through the orifice invert. The Borough of Wellsboro maintains an intake and pump house at the reservoir for water supply. During flood conditions no operations are conducted. The principal spillway and emergency spillway are designed to control the Probable Maximum Flood.

### 1.3 Pertinent Data.

a. Drainage Area. 8.3 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site

June 1972  
Approximately 440  
Elevation 1453.0

24" drain line at normal pool,  
elevation

Approximately 30

Emergency spillway capacity at top of dam elevation	20,100
Principal spillway capacity at top of dam elevation	470

c. Elevation (U.S.G.S. Datum) (feet). - Elevations worked from principal spillway orifice at elevation shown on as-built drawings.

Top of dam - low point	1463.9
Top of dam - design height	1462.2
Maximum pool - design surcharge	1462.2
Full flood control pool	1453.2
Emergency spillway crest	1453.2
Normal pool	1427.5
Principal spillway crest	1441.0
Upstream portal orifice invert	1427.5
Upstream portal 24" drain line	1390.0
Downstream portal 48" principal spillway line	1383.0
Streambed at centerline of dam	1388.0
Maximum tailwater	None
Toe of dam	1383.0

d. Reservoir (feet).

Length of maximum pool	5,700
Length of normal pool	3,000
Length of flood control pool	5,700

e. Storage (acre-feet).

Normal pool	543
Flood control pool (to emergency spillway crest)	1898
Top of dam	2900

f. Reservoir Surface (acres).

Top of dam	100
Maximum pool	100
Flood control pool	80
Emergency spillway crest	80
Normal pool	34

g. Dam.

Type	Earthfill
Length	1365 feet
Height	76 feet
Top width	22 feet
Side slopes - upstream	3H:1V with berm
- downstream	2H:1V with berm
Zoning	Yes
Impervious Core	Yes, upstream
Cutoff	Partial cutoff
Grout Curtain	None

h. Reservoir Drain.

Type	24" pipe to 48"
Length	principal spillway pipe
Closure	400 feet
	Slide gate on principal
	spillway tower
Access	Upstream toe of dam
Regulating facilities	Slide gate on
	principal spillway tower

i. Spillway.

Type	Open cut, trapezoidal
Length	175 feet
Crest elevation	1453.2
Gates	None
Upstream channel	Lake
Downstream channel	200 foot long open cut
	exit channel

## SECTION 2 ENGINEERING DATA

2.1 Design. Review of information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources and the U.S. Department of Agriculture, Soil Conservation Service revealed that considerable design information was available for review. The information reviewed for this study consisted of: as-built drawings, design reports, permits, photographs of construction and inspection reports.

The hydrologic data consisted of :

- a. Hydrologic and hydraulic design criteria
- b. Design summary and work plan comparison
- c. Design storm inflow hydrograph
- d. Stage-storage data
- e. Flow-duration curve
- f. State-discharge computations
- g. Drawdown time calculations
- h. Design hydrograph computations
- i. Freeboard hydrograph computations
- j. Emergency spillway velocities and slopes
- k. Duration of flow through emergency spillway

In addition, the subsurface investigations and geology is summarized in a report format. Summaries of laboratory testing which consists of classifications, proctors, triaxials, permeabilities and consolidation tests were reviewed. A slope stability analysis was conducted for the dam. The Swedish Circle Failure Method was utilized. A minimum safety factor of 1.48 was computed on the upstream slope against full rapid drawdown effect to the base. A safety factor of 1.87 was computed for the 2H:1V downstream slope with drainage considered to be effective at the inside portion of the rock toe. The strength parameters utilized in the stability analysis are unknown.

2.2 Construction. Construction inspection reports and photographs of construction were reviewed.

2.3 Operation. Operating records are maintained by the owner. In addition, inspections are conducted on a yearly basis. Inspection reports are maintained in the SCS files.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER, Bureau of Dams and Waterways Management and the U.S. Department of Agriculture, Soil Conservation Service. Members of the Wellsboro Borough staff and the Soil Conservation Service accompanied the inspection team to answer questions on design and operation of the dam.

b. Adequacy. The type and amount of design data and other engineering information is substantial. The information is sufficient to complete a Phase I Report.

### SECTION 3 VISUAL INSPECTION

#### 3.1 Findings.

a. General. The onsite inspection of Hamilton Lake Dam was conducted by personnel of L. Robert Kimball and Associates accompanied by an employee of the Borough of Wellsboro and staff from the Soil Conservation Service on June 28, 1979. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portions of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in good condition. The dam appears to conform closely to the as-built drawings. From a brief survey conducted during the inspection, it was noted that the crest of the dam is higher at the maximum section than the abutments due to the camber. The low point on the top of the dam is approximately 1.5 feet higher than the design height. The upstream slope is 3H:1V and covered with riprap below the upstream berm. The downstream slope is 2H:1V. The slopes are covered with crown vetch. No erosion, seepage or slumps were noted on either the upstream or the downstream slopes.

c. Appurtenant Structures. The reservoir level at the time of inspection was at elevation 1427.4. The emergency spillway crest is located at elevation 1453.2 which is approximately 0.6 feet higher than the design height. The emergency spillway was covered with grass and crown vetch and was in good condition. The principal spillway structure appeared to be in good condition. No deterioration of the concrete was noted. The drain line was not operated during the inspection. The impact basin is in good condition.

d. Reservoir Area. The watershed is covered mostly with farmland or woodland. The reservoir slopes are moderate and are not susceptible to massive landslides which would affect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel from Hamilton Lake Dam is narrow to moderately wide with a gentle grade. Several commercial structures are located approximately 2000 feet downstream of the dam. Approximately 100 dwellings (400 people) live within the affected downstream area. Charleston Creek flows through the town of Wellsboro located approximately 1/2 mile downstream of the dam.

3.2 Evaluation. The embankment and appurtenant structures appear to be in good condition and well maintained. No wet areas, slides or slumps were noted on the embankment. The thick growth of crown vetch may have obscured minor erosion areas.

SECTION 4  
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at the orifice invert (elevation 1427.5). Water is pumped from the reservoir for water supply needs of Wellsboro. The drain line is left partially open to pass a minimum of 1.5 cfs downstream of the dam. During flooding no operations are conducted. The principal spillway and emergency spillway are designed to act without any operations.

4.2 Maintenance of the Dam. Maintenance is performed by the municipal authority staff. Maintenance of the dam is considered good.

4.3 Maintenance of Operating Facilities. The valve on the drain line is operated on an as-needed basis, mostly during the inspections. The valves are operated and lubricated on a semi-annual basis. Maintenance of the operating facilities is considered good.

4.4 Warning System in Effect. There is no official warning system in effect. However, the Wellsboro Fire Department maintains a fire truck and personnel at the dam during all major flooding.

4.5 Evaluation. Maintenance of the dam and operating facilities is considered good. There is no warning system in effect to warn downstream residents of large spillway discharges or failure of the dam.

SECTION 5  
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. Hydraulic and hydrologic information are contained in the design report by the Soil Conservation Service, U.S. Department of Agriculture. Pertinent data is based on SCS criteria and is as follows:

Structure Classification: Class "C" structure (high hazard)  
Drainage Area: 8.27 square miles  
Time of Concentration: 4.08 hours  
Emergency spillway hydrograph: 6 hrs. point rainfall,  
Precipitation=11.1 inches  
Antecedent Moisture Condition III  
Curve Number=91  
Freeboard hydrograph: 6 hrs. point rainfall,  
Precipitation=22.3 inches  
Antecedent Moisture Condition II  
Curve Number=75

b. Experience Data. The maximum flood to date was during June, 1972 when the reservoir water surface reached approximately elevation 1453.0. This water level was approximately 0.2 feet below the emergency spillway crest.

c. Visual Observations. The principal spillway and emergency spillway structures appear to be in good condition. Even though the emergency spillway crest is approximately 0.6 feet higher than the design height, the top of dam is approximately 1.5 feet higher than the design. This added height on the top of dam more than compensates for the raise in the spillway crest.

d. Overtopping Potential. To determine the overtopping potential for the Hamilton Lake Dam, a review of design calculations was conducted. The design calculations consist of an inflow hydrograph, stage-discharge computations and stage-storage computations. Using a triangular unit hydrograph with 22.3 inches of rainfall over the drainage area, the peak inflow was determined to be 17,216 cfs. The spillway discharge capacity was 16,400 cfs. Based on the high hazard classification and intermediate size clarification the Spillway Design Flood (SDF) is the PMF.

e. Spillway Adequacy. Based on our inspection and review of the design data, the design calculations appear to be adequate to meet the Corps of Engineers guidelines. Design calculations indicated the dam is capable of handling the PMF. The spillway capacity is adequate.

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. No signs of slumping, erosion or instability were noted during the inspection. The embankment appears to be in good condition.

b. Design and Construction Data. Stability analyses were conducted for the design of the dam (See Section 2.1 for more detailed information). The stability analyses appear to be adequate.

c. Operating Records. Good operating records are maintained by the owner and by the Soil Conservation Service. Safety inspections are conducted on a yearly basis.

d. Post Construction Changes. There have been no post construction changes to the dam.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analysis has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. Because of the low risk of seismic occurrence and the visual observations, no static analysis is required.

SECTION 7  
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in good condition. The visual observations, review of available information, hydrologic review and past operational performance indicate that Hamilton Lake Dam's spillway is adequate. The spillway is capable of controlling the PMF without overtopping. Adequate stability analyses have been conducted for the design of the structure.

b. Adequacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations suggested below should be implemented.

d. Necessity for Further Investigation. No further investigations are required at this time.

7.2 Recommendations/Remedial Measures.

1. Continue annual safety inspections and operation and maintenance inspections.

2. A warning system should be instituted to warn downstream residents of large spillway discharges or failure of the dam.

APPENDIX A

CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST  
VISUAL INSPECTION  
PHASE I

NAME OF DAM Hamilton Lake Dam COUNTY Tioga STATE Pennsylvania ID# PA 33  
 TYPE OF DAM Earthfill HAZARD CATEGORY High  
 DATE(s) INSPECTION June 28, 1979 WEATHER Cloudy, Warm TEMPERATURE 80°  
 POOL ELEVATION AT TIME OF INSPECTION 1427.4 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball - L. Robert Kimball and Associates  
James T. Hockensmith - L. Robert Kimball and Associates  
Kuang-hwei Chuang - L. Robert Kimball and Associates  
Ron Woodhead - Borough of Wellsboro  
Don Lindsey - Soil Conservation Service  
Rich Mackalitas - Soil Conservation Service  
James T. Hockensmith RECORDER

# EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None. Partially obscured by high crown vetch.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment appears to be good. Vertical alignment - good.	
RIPRAP FAILURES	None.	

# EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Crown vetch on both upstream and downstream slopes and crest.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be good.	
ANY NOTICEABLE SEEPAGE	No seepage noted.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	Drainage outlets into impact basin. No drainage noted.	

**CONCRETE/MASONRY DAMS**

<b>VISUAL EXAMINATION OF</b>	<b>OBSERVATIONS</b>	<b>REMARKS OR RECOMMENDATIONS</b>
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

**CONCRETE/MASONRY DAMS**

<b>VISUAL EXAMINATION OF</b>	<b>OBSERVATIONS</b>	<b>REMARKS OR RECOMMENDATIONS</b>
<b>SURFACE CRACKS CONCRETE SURFACES</b>	N/A	
<b>STRUCTURAL CRACKING</b>	N/A	
<b>VERTICAL AND HORIZONTAL ALIGNMENT</b>	N/A	
<b>MONOLITH JOINTS</b>	N/A	
<b>CONSTRUCTION JOINTS</b>	N/A	
<b>STAFF GAUGE OR RECORDER</b>	N/A	

# OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet conduit not unobserved except at discharge end.	
INTAKE STRUCTURE	Intake structure appears to be in good condition.	
OUTLET STRUCTURE	Impact basin in good condition.	
OUTLET CHANNEL	Good condition.	
EMERGENCY GATE	Not opened during inspection.	

# UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None. Grassed control section.	
APPROACH CHANNEL	Open cut, grassed.	
DISCHARGE CHANNEL	Open cut, grassed.	
BRIDGE AND PIERS	None.	

# GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

# DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Narrow to moderately wide.	
SLOPES	Stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 100 homes (400 people) and several businesses.	

# RESERVOIR

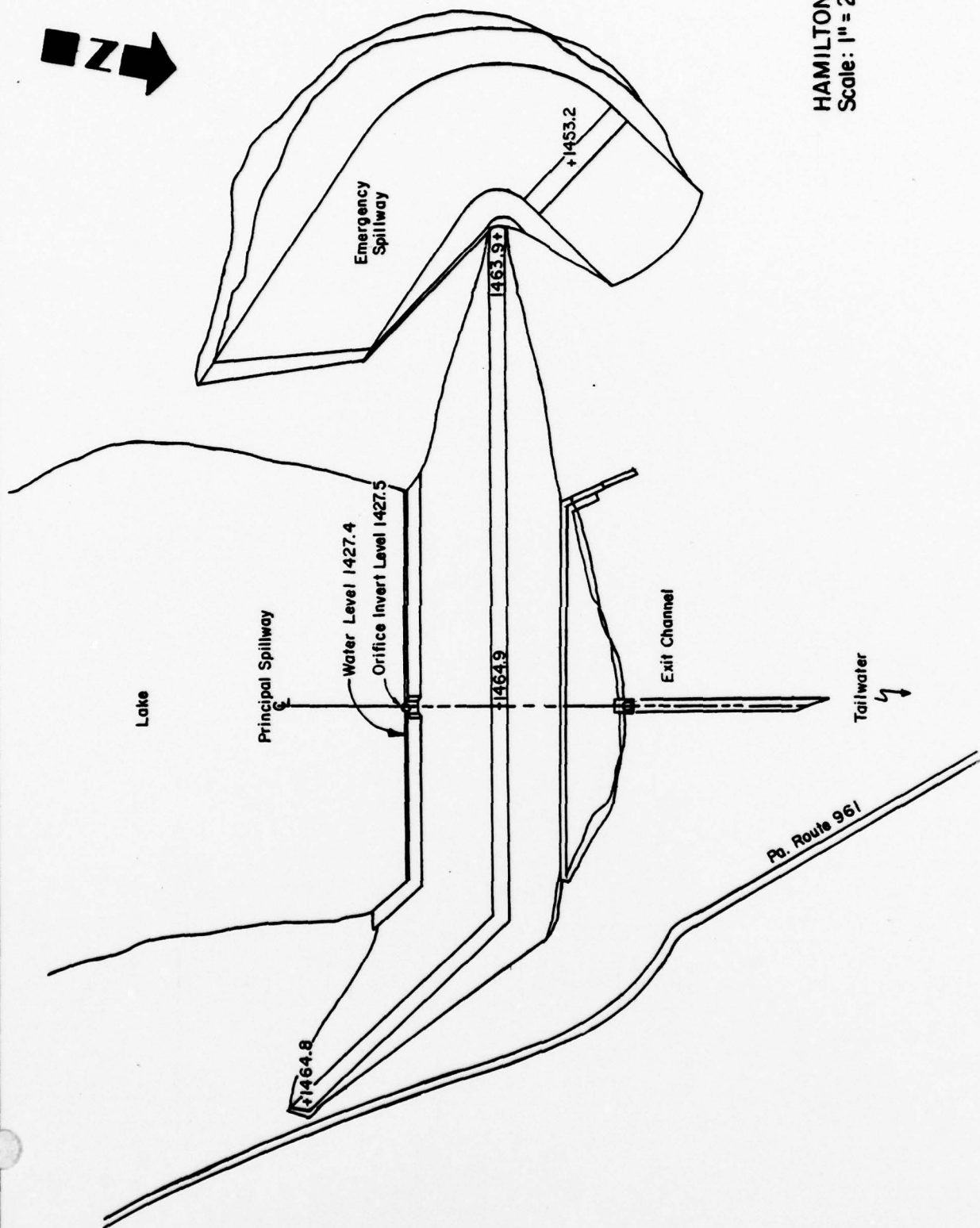
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderately steep, stable.	
SEDIMENTATION	Does not appear to be excessive.	

# INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



HAMILTON DAM  
Scale: 1" = 200'



APPENDIX B

CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

**CHECK LIST**  
**ENGINEERING DATA**  
**DESIGN, CONSTRUCTION, OPERATION**  
**PHASE I**

NAME OF DAM Hamilton Lake Dam

ID# PA 33

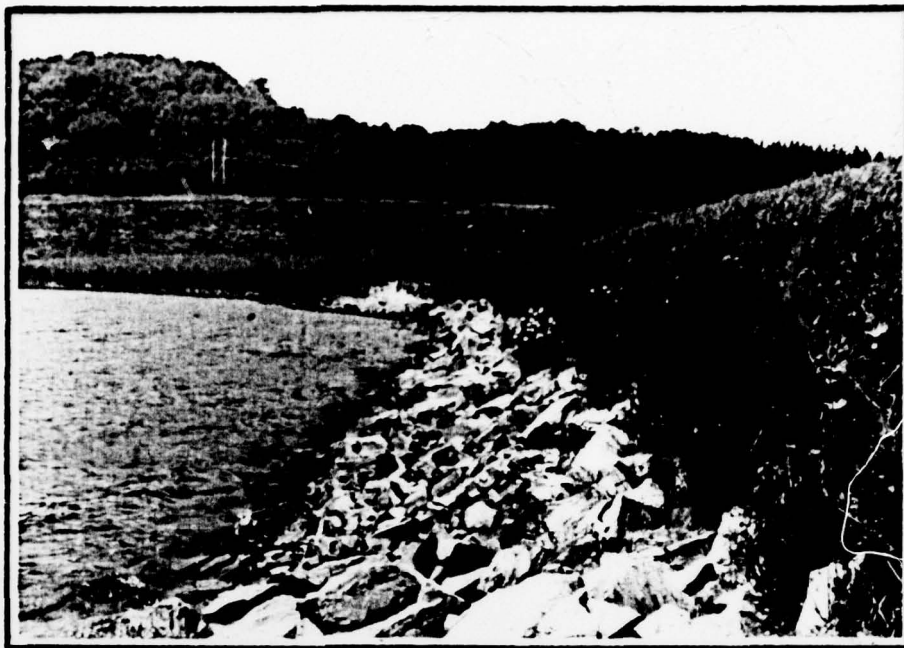
ITEM	REMARKS
AS-BUILT DRAWINGS	Yes, from Soil Conservation Service.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle and construction drawings.
CONSTRUCTION HISTORY	Inspection reports in Pennder and SCS files.
TYPICAL SECTIONS OF DAM	None.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	Construction drawings. Construction drawings. Hydrologic report. Hydrologic report. None

ITEM	REMARKS
DESIGN REPORTS	SCS files.
GEOLOGY REPORTS	SCS files.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	SCS files.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	SCS files.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Construction drawings.

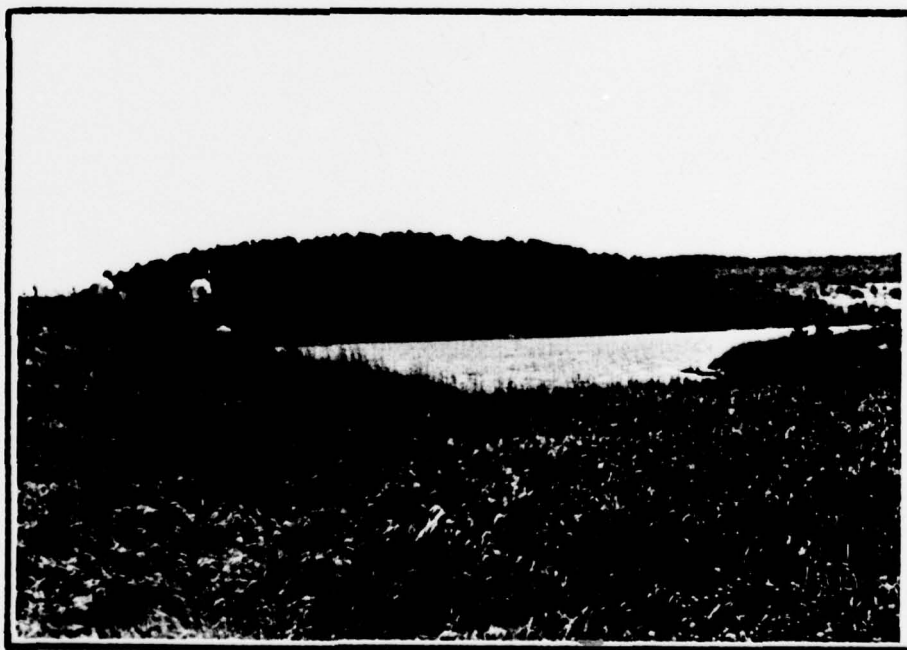
ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	SCS files.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Construction drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Construction drawings.

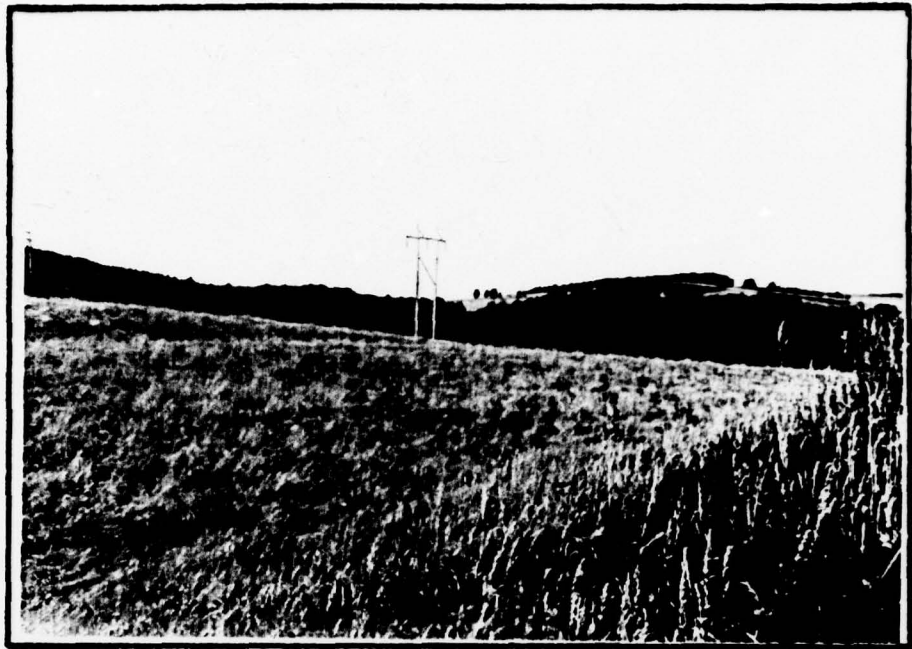
APPENDIX C  
PHOTOGRAPHS



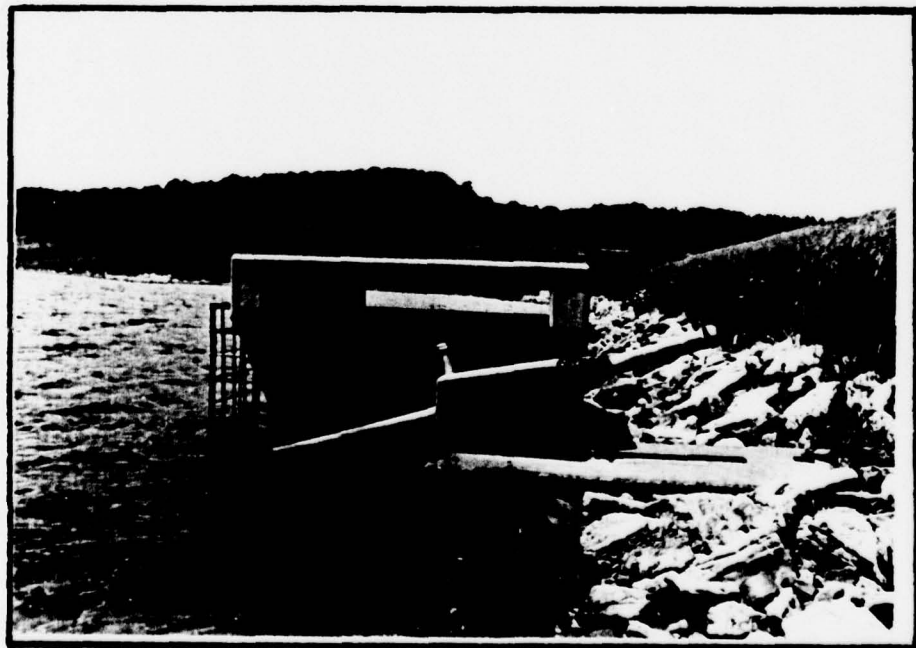
Upstream slope of dam showing riprap and emergency  
spillway approach.



Emergency spillway approach channel.



Emergency spillway discharge channel.



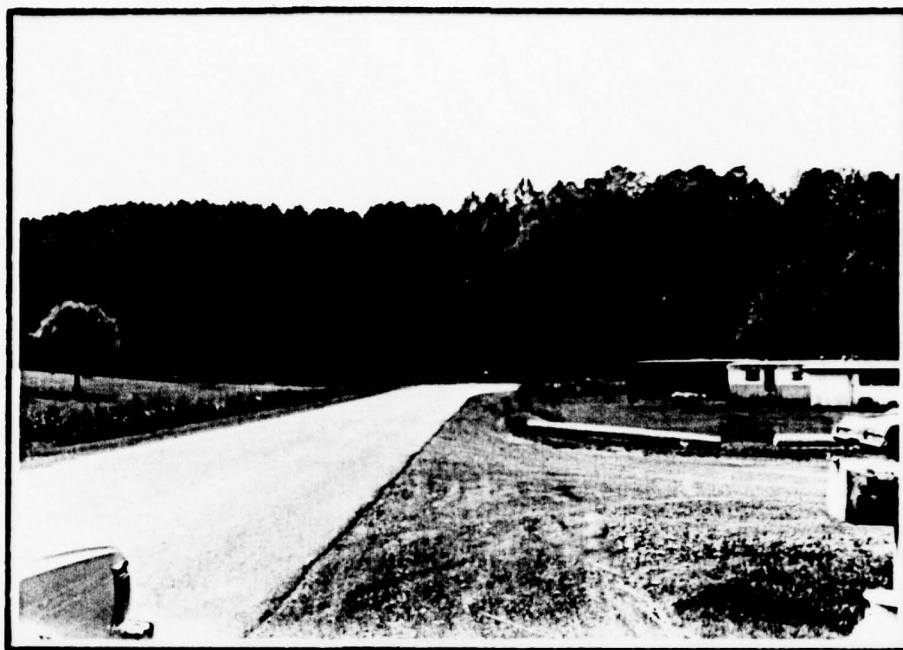
Principal spillway, orifice invert and drain line stem.



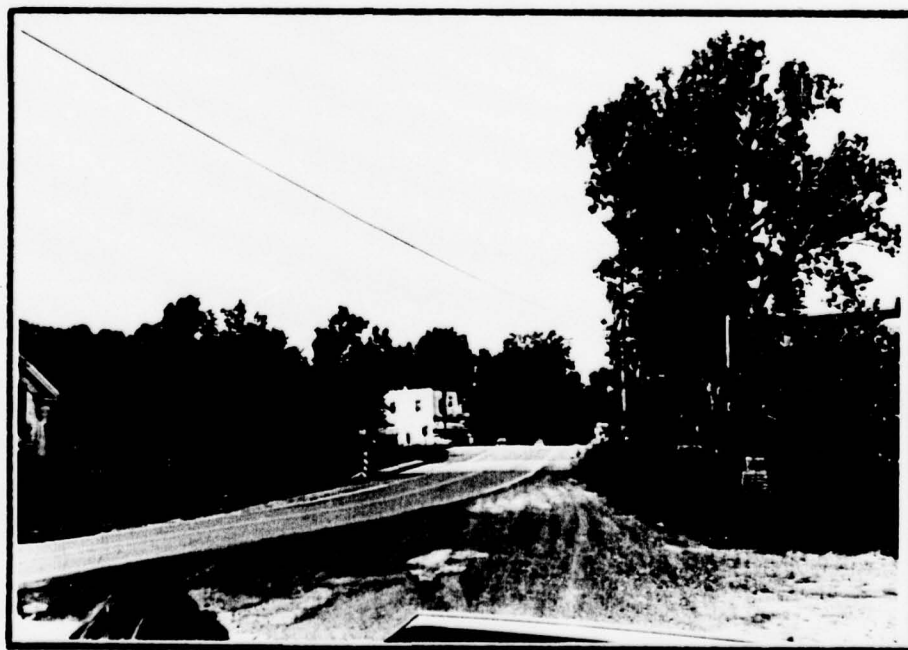
Outlet works and principal spillway discharge.



Tailwater at outlet works discharge.



First downstream residences.



Downstream residences.

APPENDIX D  
HYDROLOGY AND HYDRAULICS

CHECK LIST  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 8.3 square miles, farmland and woodland

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1427.5 (543 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1453.2 (1898 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 1462.2

ELEVATION TOP DAM: 1463.9

SPILLWAY CREST:

- a. Elevation 1453.2
- b. Type Uncontrolled open cut
- c. Width 30 feet
- d. Length 175 feet
- e. Location Spillover Left abutment
- f. Number and Type of Gates None.

OUTLET WORKS: -Principal spillway

- a. Type Control structure with 48" pipe
- b. Location Through dam
- c. Entrance inverts 1441.1 - weir elevation
- d. Exit inverts 1383.0
- e. Emergency draindown facilities 24" pipe operated from control tower.

HYDROMETEOROLOGICAL GAUGES:

- a. Type None.
- b. Location \_\_\_\_\_
- c. Records \_\_\_\_\_

MAXIMUM NON-DAMAGING DISCHARGE: June 1972, elevation approximately 1453.0  
estimated 440 cfs.

Marsh Creek Watershed  
PA-602

3-27-64  
LET

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Design Assumptions + Procedures.

1. Class 'C' Structure
2. Determine Stage-Storage data assuming top of dam at elevation 1459.0, top width of 22', 3:1 upstream slopes and 10' berm at elevation 1422.0.
3. Determine elevation of orifice crest using 'Reservoir Sediment design summary, water supply requirements (From Unit - low flow augmentation, evaporation + seepage loss calculations + stage-storage)
4. Determine elevation of riser crest using 'Reservoir Sediment design Summary and 12" stage-storage from work plan, + stage-storage.
5. Determine emergency spillway crest elevation using storage indicated in the work plan (Check this value using TP-40 data and TR-10 procedure or Key flood data, whichever is greater)
6. Compute stage-discharge data using 42" I.D. R.C.P. and 2:1 emergency spillway sideslopes
7. Compute and route design hydrograph using M.C.III and 1.25 times 6 hr rainfall data shown in Hydrology Guide, Suppl A. fig 3.21-1-3+-3.
8. Compute and route freeboard hydrograph using M.C.II and 2.50 times 6 hr rainfall data shown in Hydrology Guide, Suppl A. fig 3.21-1-2+-3.
9. Set top of dam elevation by adding 2.0' to D.H.W. as found in step 7 above, at elevation determined in step 8 above, or at elevation required to pass Pa. Dept of Forest + Waters 'C' Curve, whichever is greatest.
10. Determine critical slope of emergency spillway outlet channel at 25% of max. design discharge.
11. Check emergency spillway velocities at discharges corresponding to D.H.W. + top of dam elevations
12. Check duration of flow in emergency spillway using procedure outlined in 'Flood Routing through Reservoirs.'
13. Determine top width of dam using  $W = \frac{H+35}{5}$

See attached memo

Craig M. Right, State Conservation Engineer

February 25, 1964

Donald von Wolffradt, Hydraulic Engineer

Hydrologic Analysis Explanation - Marsh Creek Watershed

1. Provide protection for the key flood (not necessarily storing it).
2. Flood routed key storm both at present conditions and future conditions (with program installed).
  - (a) Allow emergency spillway to operate but delaying peak discharge at damage centers so as not to exceed the peak discharge of the uncontrolled area.
  - (b) Sufficient flood storage to eliminate damage in Wellsboro (based on results of water surface profile computations).

3. A two-stage principal spillway is needed on sites 600 and 602 to control short duration storms.

Storage shown in Work Plan for first stage is adequate to provide protection for short duration storms.

4. The total flood water storage indicated in the Work Plan, along with emergency spillway flow, is sufficient to meet the project objectives; namely, eliminate damages for the key flood or 100 year return interval storm, whichever is greater.
5. The key storm of 6.50 inches of rainfall for 12 hour duration exceeds the U. S. Weather Bureau T.P. 40 100-year frequency 12 hour duration rainfall of 4.9 inches.

## MARSH CREEK WATERSHED

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LET

## Design Summary + Work Plan Comparison

	UNITS	WORK PLAN	DESIGN
Drainage Area	Sq. mi.	8.27	8.27
<u>Storage Capacity</u> : Sediment	Ac.-ft.	107	108.0
Recreation	Ac.-ft.	—	—
Water Supply	Ac.-ft.	313	435*
Floodwater	Ac.-ft.	1,355	1,355
Total	Ac.-ft.	1,750	1,898
Between High & Low Stages	Ac.-ft.	.602	.613
<u>Surface Area</u> : Water Supply	Acres	30.0	34.2
Floodwater Pool	Acres	72.0	77.5
Volume of fill	Cu. yd.	256,98	—
Elevation top of dam	ft.	1459.0	1462.2
Maximum height of dam	ft.	72	76
<u>Emergency Spillway</u> Crest Elev.	ft.	1449.0	1452.6
Bottom width	ft.	175	175
type		50d	50d
% Chance of use		1	1
Ave Curve No. (Cond. II)		75	75
<u>Emergency Spillway Hydrograph</u> Storm Rainfall (6 hr)	in.	9.8	9.8
Storm Runoff	in.	8.71	8.71
Velocity of flow	ft/sec	11	10.5
Discharge Rate	cfs	6950	7120
Max W.S. Elev	feet	1455.1	1458.4
<u>Free board Hydrograph</u> : Storm Rainfall (6 hr)	in	19.6	17.6
Storm Runoff	in	16.1	16.1
Velocity of flow	ft/sec	14.1	13.8
Discharge Rate	cfs	15,560	16,000
Max W.S. Elev	feet	1458.9	1462.2
<u>Principal Spillway</u> : Cap. Low Stage	cfs	124	132
Cap. High Stage	cfs	377	424
<u>Capacity Equivalents</u> : Sed Vol.	in.	0.19	0.19
Detention Volume	in.	3.03	3.07
Spillway Storage	in.	1.05	1.14
Class of structure	—	C	C

This value includes ...

2-25-64  
LET

LET

top of dom at 1459.0 22' t.w. 3:1 U.S. 5/16 pos 10' berm @ 1422

(1) Elev.	(2) $\text{in}^2$ Area	(3) $2 \times \frac{49,000}{43,560}$ Ac. Area	(4) Ac. $\Sigma \text{ Area}$	(5) ft. $\Delta \text{ Elev}$	(6) $\frac{(2) \cdot (5)}{2}$ Ac-ft. Stor.	(7) Ac-ft. $\Sigma \text{ Stor}$	Planim Check 3-17-64 amj
1390.5	0	0					0
			5.05	10			
1400	5.50	5.05			25.3	25.3	5.24
			13.70	5			
1405	9.42	8.65			34.3	59.6	9.41
			21.82	5			
1410	14.35	13.17			55.6	115.2	14.16
			31.31	5			
1415	19.76	18.14			78.3	193.5	19.68
			43.36	5			
1420	27.47	25.22			108.4	301.9	27.19
			62.36	10			
1430	40.46	37.14			311.8	613.7	44.13
			90.39	10			
1440	58.01	53.25			452.0	1065.7	61.53
			125.91	10			
1450	79.15	72.66			629.6	1695.3	80.15
			169.31	10			
1460	105.28	96.65			846.6	2541.9	105.34
			216.17	10			
1470	130.16	119.52			1080.9	3621.8	
				D=6		✓ amj 3-17-64	

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MARSH CREEK W/S

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6424

TR-10 RUNOFF DATA

[illegible]

MARSH CREEK W/S  
PA-602  
STAGE-DISCHARGE FORMULAS

13  
3-19-64  
GAY

OFFICE

$$Q = CA\sqrt{2gH} = 124 \text{ cfs @ elev. } 1440.5' = Q_{\text{max}}$$

$$H_{\text{max}} = 1440.5 - 1427.5 = 13.0'$$

$$A = Q / C\sqrt{2gH} = 124 / 0.65(64.4 \times 13.0)^{1/2} = 124 / 0.65(28.93) = 6.59 \text{ ft}^2$$

with height = 2.0',  $L = 6.59/2 = 3.30'$  (use 3.5')  $\frac{7}{3} = 2.33$

$$Q_{\text{max}} = 0.65(2.0 \times 3.5) \sqrt{64.4(13.0)} = 132 \text{ cfs (OK - W.P.P. uses up to 15.)}$$

$$= 0.65(7.0)(8.025) H^{1/2} = 36.51 H^{1/2}$$

EIR

$$\text{Riser Inside Dimensions} = 4.0' \times 12.0'$$

$$Q = CLH^{3/2} = 3.1(24.0) H^{3/2} = 74.4 H^{3/2}$$

PIPE

$$Q = A \left( \frac{2gH}{1 + K_r + K_p L} \right)^{1/2}$$

48" ID Riser  
 $n = 0.013$   
 $L = 330$

$$= \frac{12.57(8.025) H^{1/2}}{(1 + 1.0 + 0.00493[330])^{1/2}} = \dots$$

$$= \frac{12.57(8.025) H^{1/2}}{(3.63)^{1/2}} = 52.95 H^{1/2}$$

1.905

Note Use Orifice size = 3' x 2.2' = 3'00" x 2'3"  $\frac{7}{3} = 2.33$

~~W.P.P.~~

MARSH CREEK W/S PA-602

STAGE-DISCHARGE COMPUTATIONS

STAGE	$H_o$ (@ 1427.5)	$H^{1/2}$	$Q_o =$ $36.51 H^{3/2}$	$H_w$ (crest @ 1440.0)	$H^{3/2}$	$Q_w =$ $74.40 H^{3/2}$	$Q_o + Q_w$	$H_p$ (cut at E @ 1350.0)	$H_p^{1/2}$
1426.5	—	—	—	—	—	—	—	—	—
1427.5	0	0	0	—	—	—	0	—	—
1428.0	0.5	0.71	26	—	—	—	26	—	—
1429.0	1.5	1.22	45	—	—	—	45	—	—
1430.5	3.0	1.73	63	—	—	—	63	—	—
1433.5	5.0	2.24	82	—	—	—	82	—	—
1435.5	8.0	2.83	103	—	—	—	103	—	—
1440.5	13.0	3.61	132	0	0	0	132	52.5	7.25
1441.5	13.5	3.67	134	0.5	0.35	26	160	53.0	7.28
1441.5	14.0	3.74	137	1.0	1.00	74	211	53.5	7.31
1442.1	14.5	3.81	139	1.5	1.84	137	276	54.0	7.34
1442.5	15.0	3.87	141	2.0	2.83	211	352	54.5	7.37
1452.0	—	—	—	—	—	—	—	64.0	8.00
1455.8	—	—	—	—	—	—	—	65.2	8.11
1456.7	—	—	—	—	—	—	—	66.7	8.17
1457.4	—	—	—	—	—	—	—	67.4	8.22
1458.0	—	—	—	—	—	—	—	68.0	8.26
1458.1	—	—	—	—	—	—	—	69.1	8.32
1458.1	—	—	—	—	—	—	—	70.1	8.37
1458.1	—	—	—	—	—	—	—	71.1	8.42
1459.2	—	—	—	—	—	—	—	71.2	8.43
1460.7	—	—	—	—	—	—	—	72.7	8.53
1461.4	—	—	—	—	—	—	—	73.4	8.58
1462.8	15.3	3.91	143	2.3	3.49	260	403	74.5	8.63
1470.1	2.6	1.61	59	—	—	—	—	—	—
1480.0	2.5	1.58	58	—	—	—	—	—	—
1463.0	—	—	—	—	—	—	—	74.0	8.60
1463.9	—	—	—	—	—	—	—	—	—



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Marsh Creek Watershed

3-26-64

PA-602

LET

Drawdown time Calculations

①	②	③	④	⑤	⑥	⑦	⑧	
Elev	Ac-ft	Ac-ft	cfs	cfs	12.1x⑥ hrs	days	days	
	Stor	Δ Stor	Q <sub>net</sub>	Q <sub>avg</sub>	time	time	Σ time	
1452.0	1848		394					
		623		378				
1442.0	1225		362		19.9	0.83	0.83	
		15		342				
1442.5	1210		322		0.5	0.02	0.85	
		30		284				
1442.0	1180		246		1.3	0.05	0.90	
		30		213.5				
1441.5	1150		181		1.7	0.07	0.97	
		25		155.5				
1441.0	1125		130		1.9	0.08	1.05	
		36		116				
1440.5	1095		102		3.1	0.13	1.18	
		255		87.5				
1435.5	840		73		35.3	1.47	2.65	
		130		62.5				
1432.5	710		52		25.2	1.05	3.70	
		85		42.5				
1430.5	625		33		24.2	1.01	4.71	
		55		24				
1429.0	570		15		27.7	1.15	5.86	too high
5 day drawdown elev = 1430.5								
		10		31	3.9	0.16	4.57	too low
1430.1	615		29					
		15		30.5	4.0	0.25	4.96	OK
1430.0	610		28					
				D-11			1.001	3-26-64

PA-33  
1/13/59

# DESIGN

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## HYDROGRAPH COMPUTATION FORM

Watershed MARSH CREEK State PA

Structure Site or Sub-area PA 602

Storm Distribution Curve B Hydrograph Family 1

D.A. 8.27 sq. mi., Pt. Rainfall 8.5 x 1.25 inches, Aerial Rainfall 11.1 x .93 inches

R. O. Condition III, R. O. Curve No. 91, Storm Duration or Freq. 6 1/2

$T_c = 4.08$  hrs.,  $Q = 8.71$  inches,  $T_p = 0.686$   $T_c = 2.80$ ,  $T_o = 5.73$

$\frac{T_o}{T_p}$  Computed = 2.05  $\frac{T_o}{T_p}$  used: 2 Revised  $T_p = 2.87$  hr.

$q_p = \frac{484A}{Rev. T_p} = 1395$  c.f.s.  $q_p \times Q = 12150$  c.f.s.

$f$  (column) =  $\frac{t}{T_p} \times Rev. T_p$   $q$  (column) =  $\frac{q_c}{q_p} (q_p Q)$

Check:  $Q = \frac{(\sum t)(\sum q)}{695 A}$

Table 3.21-7 (sheet 24 of 52)

Line No.	$\frac{t}{T_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.	Line No.	$\frac{t}{T_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.
1	0.00	1.000	0	0	21		.004	16.65	49
2	0.29	.007	.83	85	22		.002	17.48	24
3	0.58	.035	1.66	425	23		.001	18.31	12
4	x21	.164	2.50	199.3	24	x	.000	19.14	0
5		.432	3.33	5249	25				
6		.669	4.16	8728	26				56728
7		.740	4.99	8591	27				
8		.680	5.83	8262	28		$\%d.44$	$Q = \frac{56728 \times 2}{645 (0.21)} = 382$	
9		.561	6.66	6816	29				
10		.441	7.49	5358	30		$\%d.54 = \frac{2.82 - 2.21}{8.11} = 7.3\%$		
11		.319	8.32	3876	31				
12		.212	9.16	2576	32				
13		.137	9.99	1701	33				
14		.094	10.82	1142	34				
15		.064	11.65	765	35				
16		.042	12.48	510	36				
17		.028	13.32	340	37				
18		.017	14.15	207	38				
19	✓	.011	14.98	134	39				
20		.007	15.81	85	40				

PA-83  
1/13/53

FRESH-BOARD

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# HYDROGRAPH COMPUTATION FORM

Watershed MARSH CREEK State PA

Structure Site or Sub-area PA 602

Storm Distribution Curve B Hydrograph Family 1

D.A. 527 sq. mi., Pt. Rainfall 5.9 x 2.5 inches, Aerial Rainfall 27.3 x 4.8 inches

R. O. Condition II, R. O. Curve No. 75, Storm Duration or Freq. 6 hr.

$T_c = 4.08$  hrs.,  $Q = 16.1$  inches,  $T_p = 0.686$   $T_c = 2.80$ ,  $T_o = 5.53$

$\frac{T_o}{T_p}$  Computed = 1.98  $\frac{T_o}{T_p}$  used: 2.0 Revised  $T_p = 2.77$  hr.

$q_p = \frac{484A}{\text{Rev. } T_p} = 1445$  c.f.s.  $q_p \times Q = 23265$  c.f.s.

$f$  (column) =  $\frac{t}{T_p} \times \text{Rev. } T_p$   $q$  (column) =  $\frac{q_c}{c_p} (q_p Q)$

Table 3. 21-7 (sheet 21 of 2)

Check:  $Q = \frac{( \sum t ) ( \sum q )}{695 A}$

Line No.	$\frac{t}{t_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.	Line No.	$\frac{t}{t_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.
1	0.00	.000	0	0	21	1.00	.004	16.07	53
2	0.29	.007	.80	163	22	1.00	.002	14.57	47
3	.58	.035	1.61	814	23	1.00	.001	17.67	23
4	.87	.164	2.41	3815	24	1.00	.000	18.95	0
5	1.16	.432	3.21	10050	25			50 = 10050	
6	1.45	.669	4.02	15564	26				
7	1.74	.740	4.82	17216	27		ck		
8	2.03	.680	5.62	15820	28		.9 = 16.3		
9	2.32	.561	6.43	13052	29		% Error = $\frac{16.3 - 16.1}{16.1} = 1.2\%$		
10	2.61	.441	7.23	10260	30				
11	2.90	.319	8.03	7122	31				
12	3.19	.212	8.84	4932	32				
13	3.48	.147	9.64	3257	33				
14	3.77	.094	10.44	2157	34				
15	4.06	.063	11.25	1461	35				
16	4.35	.042	12.05	977	36				
17	4.64	.028	12.85	651	37				
18	4.93	.017	13.66	396	38				
19	5.22	.011	14.46	256	39				
20	5.51	.007	15.26	163	40				

MARSH CREEK U.S.  
DA-602

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Emergency Spillway Velocities

Design

$$\begin{aligned} H_p &= 1457.8 - 1452.0 = 5.8' \\ Q_{em} &= 7120 - 442 = 6678 \text{ cfs} \\ q_c &= \frac{6678}{182.0} = 36.7 \text{ cfs} \\ V_c &= 10.5 \text{ ft/sec (ES-98 sh } 1/4) \end{aligned}$$

Freeboard

$$\begin{aligned} H_p &= 1461.6 - 1452.0 = 9.6' \\ Q_{em} &= 16,000 - 454 = 15,546 \text{ cfs} \\ q_c &= \frac{15,546}{187.1} = 83.1 \text{ cfs} \\ V_c &= 13.8 \text{ ft/sec (ES-98 sh } 1/4) \end{aligned}$$

Emergency Spillway Slopes.

$$\begin{aligned} D.H.W. Q_{es} &= 7120 - 442 = 6678 \text{ cfs} \\ Q_{1/4} &= \frac{6678}{4} = 1670 \text{ cfs} \\ \text{tot. } Q_{1/4} &= 1670 + 432 = 2102 \text{ cfs} \end{aligned}$$

$$\begin{aligned} H_p &= 1454.6 - 1452.0 = 2.6 \text{ ft.} \\ q_c &= \frac{1670}{177.8} = 9.4 \text{ cfs} \end{aligned}$$

$$S_c = S_{o \text{ min}} = 2.1\%$$

$$S_{c(\text{max})} = S_c \left( \frac{V_{em}}{V_c} \right)^{1/3} = 2.1 \left( \frac{11.0}{10.5} \right)^{1/3} = 2.1 \times 1.177 = 2.5\%$$

✓ 3-31-64 JMR

Duration of flow in Emergency Spilling

$$T_0 = 4.85 \text{ hours}$$

$$T_1 = 6.48 \text{ hours}$$

$$S_0 = 1340 \text{ Ac-ft.}$$

$$S_{max} = 1865 \text{ Ac-ft.}$$

$$Q_{max} = 7120 \text{ cfs}$$

$$I_{max} = 3841 \text{ Ac-ft.}$$

$$I_1 = 2400 \text{ Ac-ft.}$$

$$Q_P = 442 \text{ cfs}$$

$$t_1 = T_1 - T_0 = 6.48 - 4.85 = 1.63$$

$$t_2 = \frac{(I_{max} + S_{max}) - (I_1 + S_0)}{Q_P + 0.3(Q_{max} - Q_P)} \times 12.1$$

$$t_2 = \frac{(3841 + 1865) - (2400 + 1340)}{442 + 0.3(7120 - 442)} \times 12.1$$

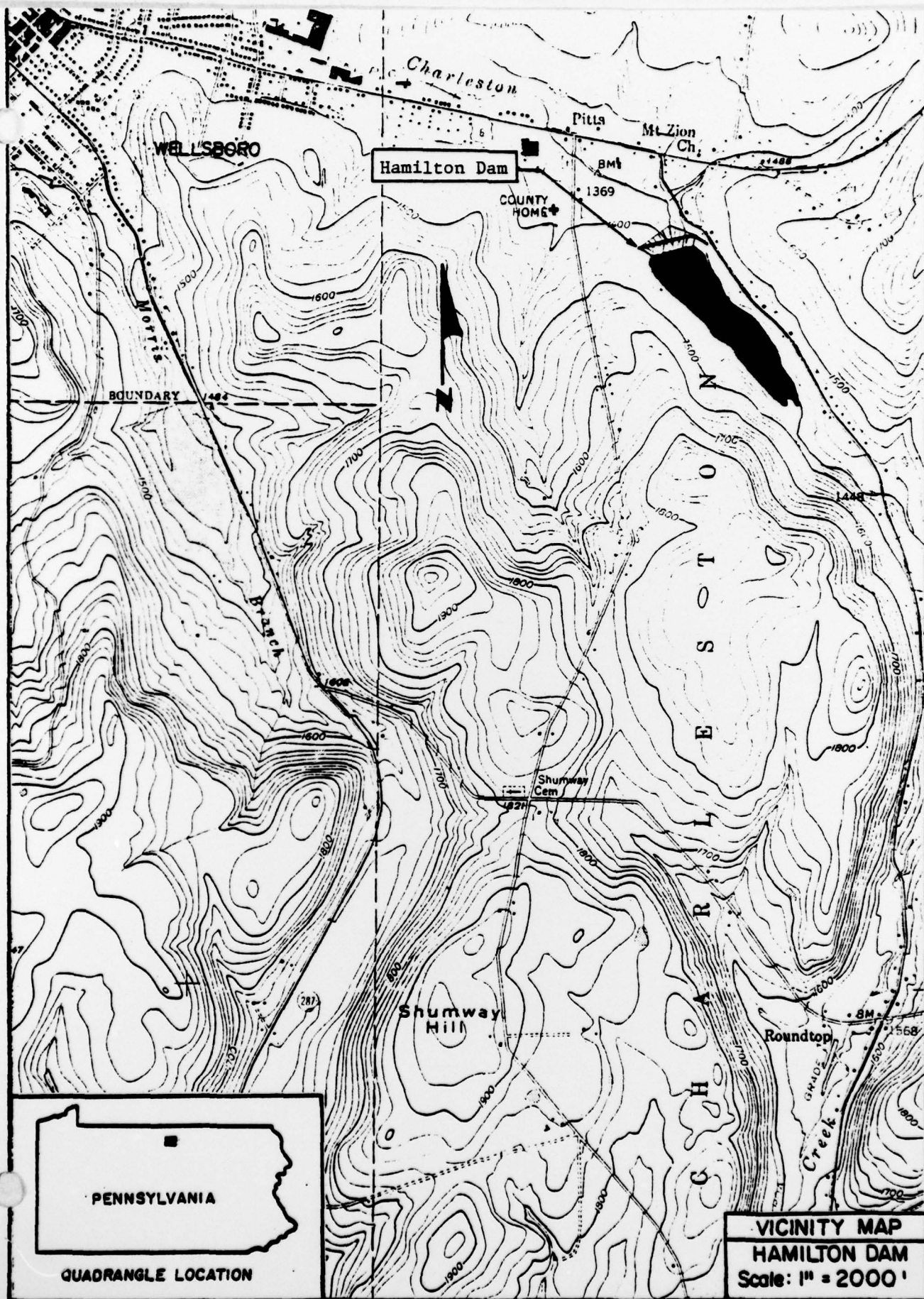
$$t_2 = \frac{1966}{442 + 2003} \times 12.1 = \frac{1966 \times 12.1}{2445} = 9.73 \text{ hrs.}$$

$$T = t_1 + t_2 = 1.63 + 9.73 = \underline{11.36 \text{ hours.}}$$

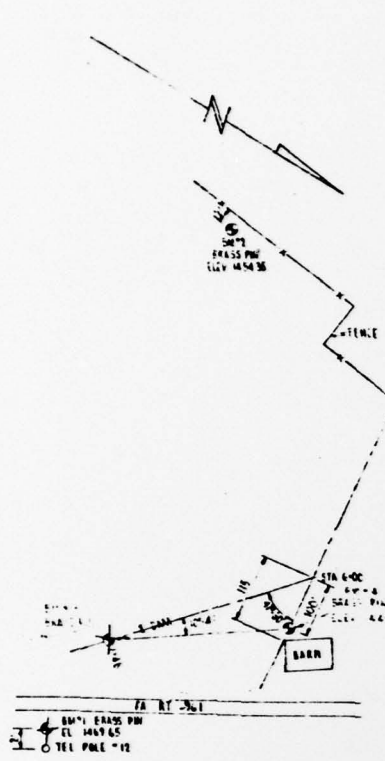
✓ 3-31-64 JMR

APPENDIX E

DRAWINGS



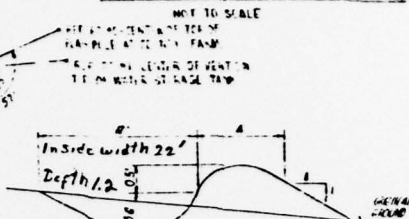
**FIGURE 1**



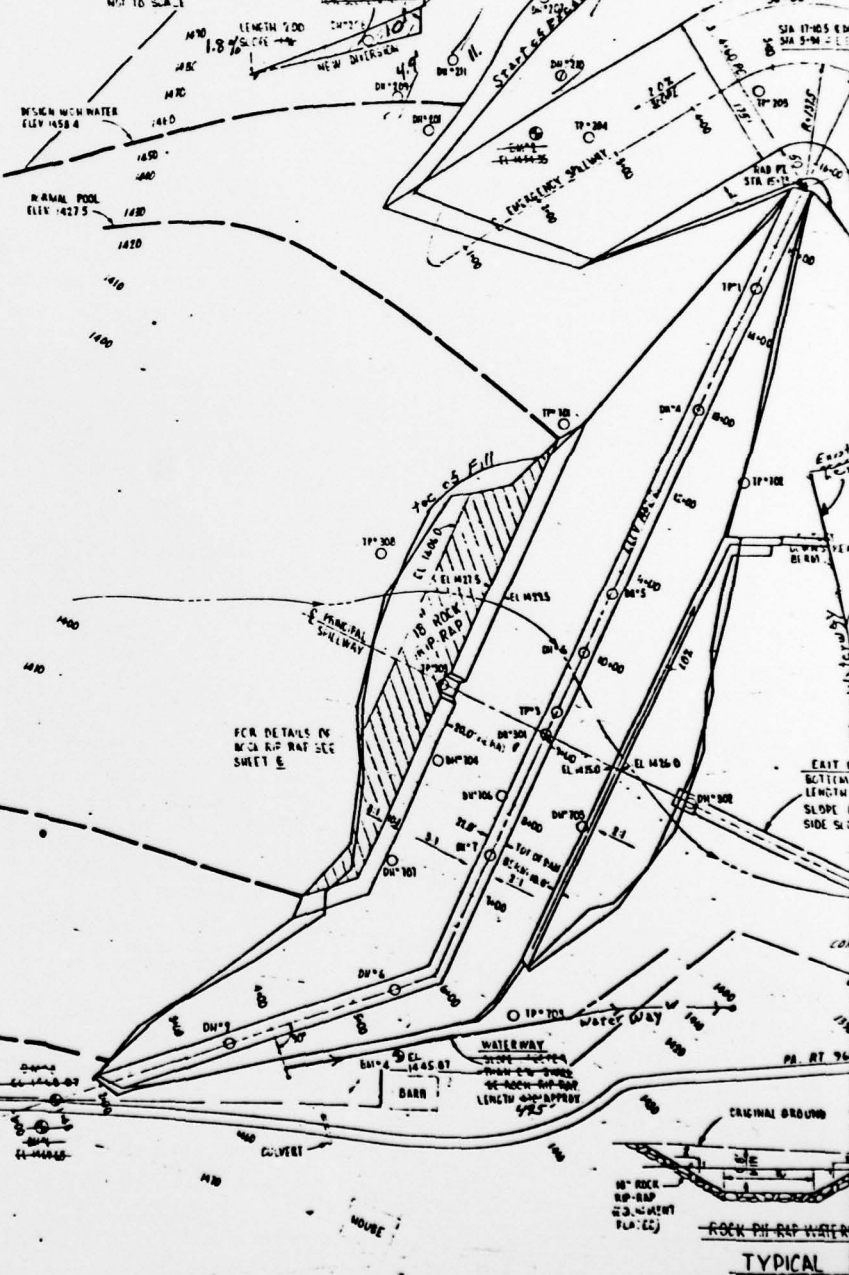
LAYOUT OF E DAM & LOCATIONS OF RM#1 & RM#2  
NOT TO SCALE

LAYOUT OF PRINCIPAL SPILLWAY  
NOT TO SCALE

TYPICAL SECTION OF ROCK RAP RAILROAD  
WATERWAY ABOVE EMERGENCY SPILLWAY



TYPICAL SECTION OF ROCK RAP RAILROAD  
WATERWAY ABOVE EMERGENCY SPILLWAY



TYPICAL

# EMERGENCY SPILLWAY ELEVATION DATA

L = 100' 00"  
 A = 15' 5"  
 T = 43.87"  
 L = 740'  
 C = 104.6'  
 H = 49.11'  
 E = 14.41'  
 P.C. = 440'  
 P.T. = 1400'

STATION	SECTION A	CEASED
P.C. 440	0' 00"	
441	1' 00"	11.00
442	2' 00"	"
443	3' 00"	"
444	4' 00"	"
445	5' 00"	"
446	6' 00"	"
447	7' 00"	"
448	8' 00"	"
449	9' 00"	"
450	10' 00"	"
451	11' 00"	"
452	12' 00"	"
453	13' 00"	"
454	14' 00"	"
455	15' 00"	"
456	16' 00"	"
457	17' 00"	"
458	18' 00"	"
459	19' 00"	"
460	20' 00"	"
461	21' 00"	"
462	22' 00"	"
463	23' 00"	"
464	24' 00"	"
465	25' 00"	"
466	26' 00"	"
467	27' 00"	"
468	28' 00"	"
469	29' 00"	"
470	30' 00"	"

Const Width 20' Bk 2 P 241

Const Depth 1.2

TYPICAL SECTION OF DIVERSION  
 (DOWNSTREAM SIDE OF D.T.)  
 W.T. TO SCALE

## AS BUILT PLANS

SCALE 1" = 100 FEET

## FIGURE 2

MARSH CREEK WATERSHED  
 MULTIPLE PURPOSE DAM PA-602  
 TIOGA COUNTY, PENNSYLVANIA

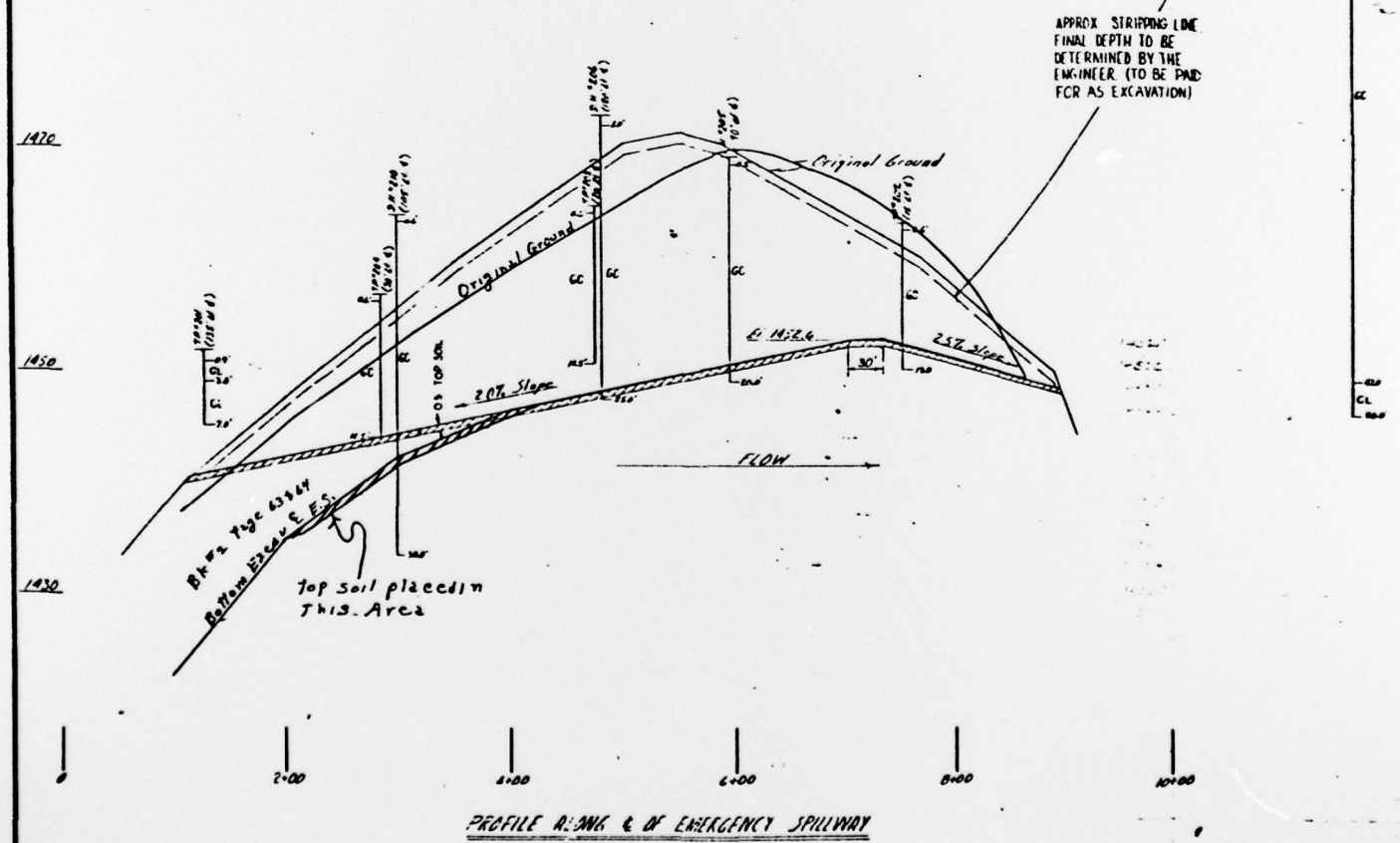
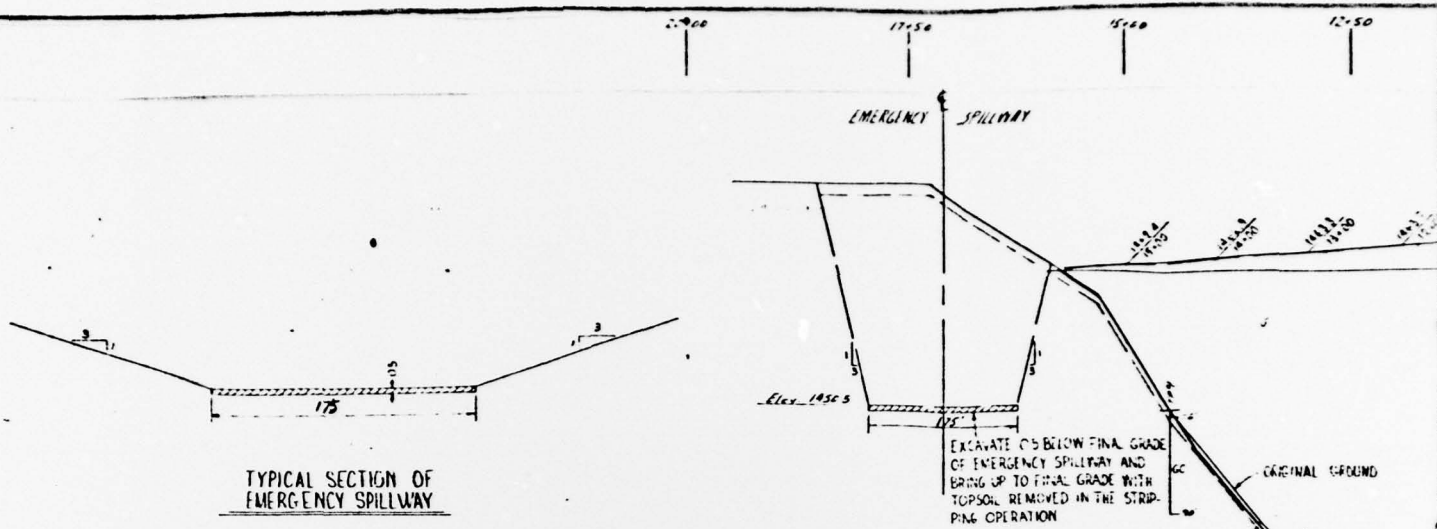
### PLAN OF DAMSITE

U. S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE

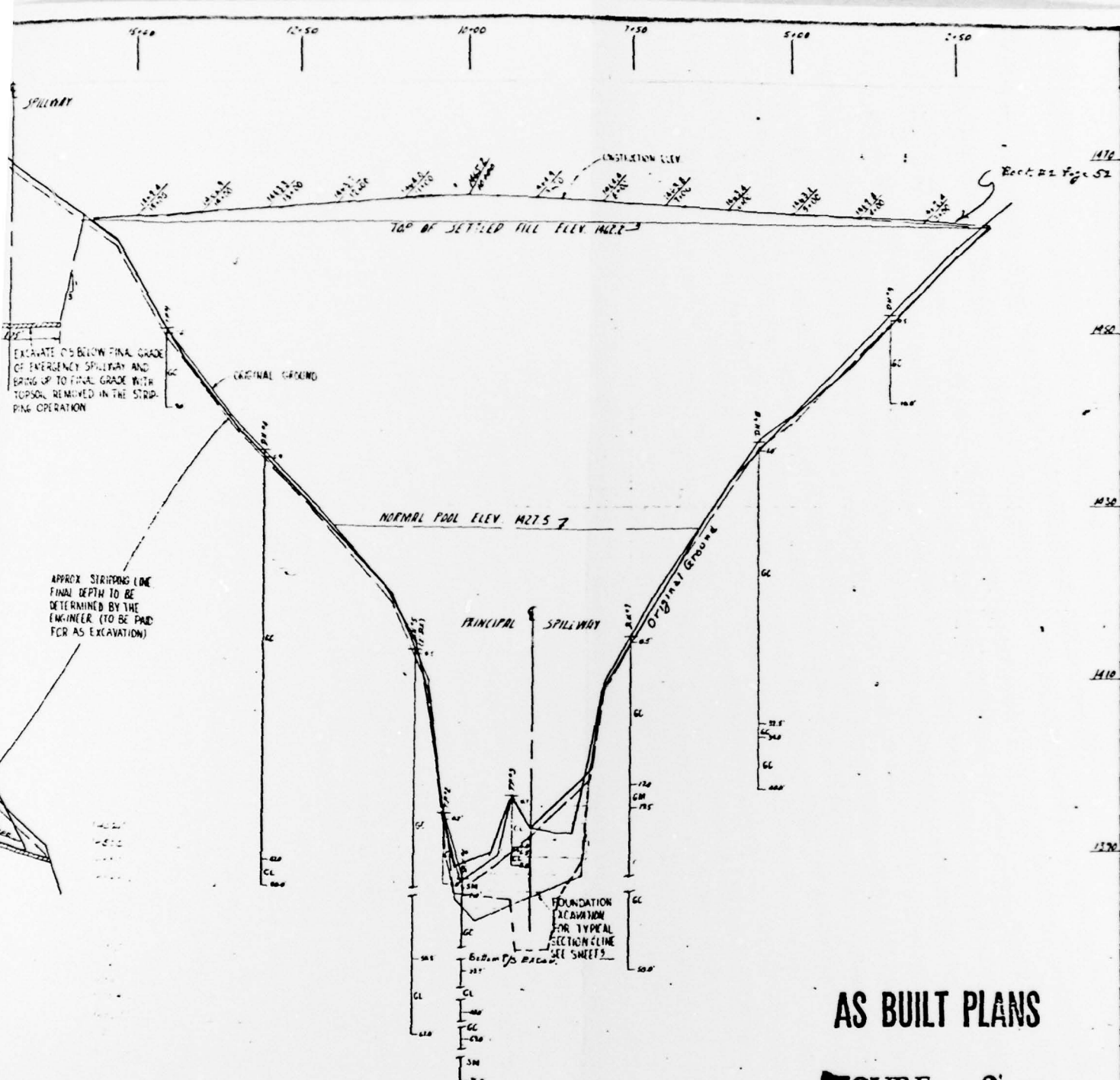
Date Approved by Drawn by Check Title Scale Project No.	Date Approved by Drawn by Check Title Scale Project No.
11-65 H. A. STALTER 11-65 11-65 11-65 11-65 11-65	11-65 11-65 11-65 11-65 11-65 11-65 11-65

PA-602-P

L. ROBERT KIMBALL & ASSOCIATES  
 CONSULTING ENGINEERS & ARCHITECTS



SEE SHEETS 22, 23, 24 AND 25 FOR LOGS OF DRILL HOLES AND TEST PITS



# AS BUILT PLANS

FIGURE 3'

PROFILE ALONG C OF DAM  
LOOKING DOWNSTREAM

MARSH CREEK WATERSHED			
MULTIPLE PURPOSE DAM PA-602			
TIOGA COUNTY, PENNSYLVANIA			
PROFILE OF DAM & EMERGENCY SPILLWAY			
U. S. DEPARTMENT OF AGRICULTURE			
SOIL CONSERVATION SERVICE			
Designed by <i>Alfred A. Snyder</i>	Date 2-65	Reviewed by R. J. MAYES	Date 4-65
Drawn by J. J. MAYES	Date 4-65	Checked by J. J. MAYES	Date 4-65
Project No. PA-602-P			Sheet No. 1 of 1

SEE SHEETS 17, 20, 21 AND 22 FOR  
LOGS OF DRILL HOLES AND TEST PITS

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

EXISTING AREA FOR RIVER  
LARGER THAN 4' RATED  
IN MINOR EXTENT TO  
BE DETERMINED BY THE  
ENGINEER

POND DRAIN INLET  
DETAILS SHEET 14  
CLASS 4000 CONCRETE

NOTE: 5' DIA. 3' RISSO  
AND 1' RISSO  
GATE WELLS AS  
SHOWN

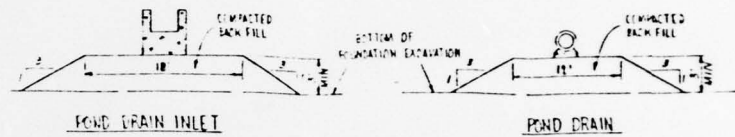
3' 1"

ELEV 1427.5  
ELEV 1427.5

PRINCIPAL  
SPILLWAY

3' 1"

PLAN VIEW  
NOT TO SCALE

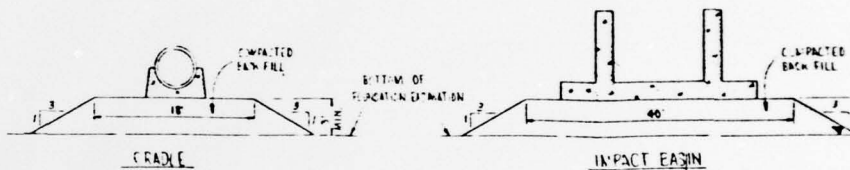


PRINCIPAL SPILLWAY PIPE JOINT DATA

JOINT	DISTANCE FROM UPPER WALL	INVERT ELEV OF 10 PIPE	ELEV. OF SURFACE
1	16.33	1390.00	1390.00
2	32.66	1389.45	1389.45
3	48.99	1388.90	1388.90
4	65.32	1388.35	1388.35
5	81.65	1387.80	1387.80
6	97.98	1387.25	1387.25
7	114.31	1386.70	1386.70
8	130.64	1386.15	1386.15
9	146.97	1385.60	1385.60
10	163.30	1385.05	1385.05
11	179.63	1384.50	1384.50
12	195.96	1383.95	1383.95
13	212.29	1383.40	1383.40
14	228.62	1382.85	1382.85
15	244.95	1382.30	1382.30
16	261.28	1381.75	1381.75
17	277.61	1381.20	1381.20
18	293.94	1380.65	1380.65

ANTI-SLEEP COLLAR DATA

CELLAR	DISTANCE FROM RIVER DAM	INVERT ELEV OF 48" DRAIN
I	22.00	1389.53
II	44.00	1389.04
III	66.00	1388.55
IV	88.00	1388.06
V	110.00	1387.57
VI	132.00	1387.08



NOTE: DIMENSIONS OF PIPE ARE BASED  
ON MINOR SIZE AND DO NOT  
INCLUDE GREEP

NATURAL GRASS

Book #2 Page 10

ELEV 1426.0

APPLY BOTTOM OF FOUNDATION  
EXCAVATION FINAL DEPTH TO BE  
DETERMINED BY THE  
ENGINEER

POND DRAIN PIPE JOINT DATA

N°	DISTANCE FROM UPPER WALL	INVERT ELEV
1	16.33	1389.99
2	32.66	1389.12
3	48.99	1388.27
4	65.32	1387.42
5	81.65	1386.57
6	97.98	1385.72
7	114.31	1384.87
8	130.64	1384.02
9	146.97	1383.17
10	163.30	1382.32
11	179.63	1381.47
12	195.96	1380.62
13	212.29	1379.77
14	228.62	1378.92
15	244.95	1378.07
16	261.28	1377.22
17	277.61	1376.37
18	293.94	1375.52

NOTE: DIMENSIONS OF PIPE ARE BASED  
ON MINOR SIZE AND DO NOT  
INCLUDE GREEP

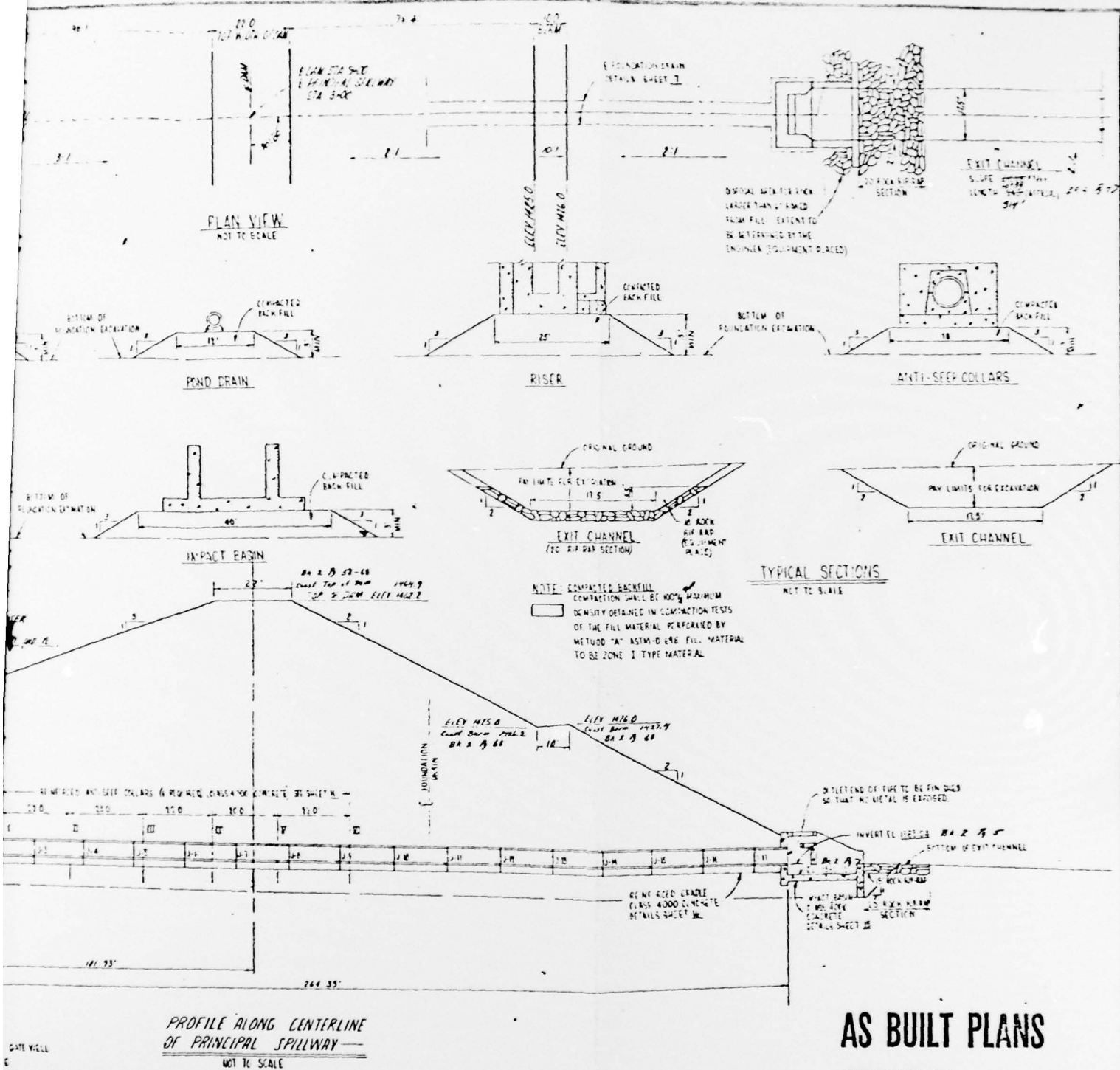
Book #2 Page 10

APPLY BOTTOM OF FOUNDATION  
EXCAVATION FINAL DEPTH TO BE  
DETERMINED BY THE ENGINEER

PROFILE ALONG CENTERLINE  
OF POND DRAIN  
NOT TO SCALE

PROFILE ALONG CENTERLINE  
OF PRINCIPAL SPILLWAY  
NOT TO SCALE

24" INSIDE DIA. REINFORCED CONCRETE PRESSURE PIPE  
7'-10" SECTIONS  
1'-8" SECTIONS  
1'-6" FEMALE WALL PIECE FOR 10" WALL  
PRESSURE HEAD 70'  
LOAD = 22,300 LBS PER LIN. FT. BASED ON OD OF 30"  
MIN. 3' EDGE BEARING STRENGTH FOR  
OD 30" CRACK NON PRESTRESSED PIPE = 7,450 LBS PER LIN.  
OD 30" CRACK PRESTRESSED PIPE = 5,400 LBS PER LIN.  
TOTAL LENGTH 111.30'  
B.A. 2. 8. 1. 1' and 1' more



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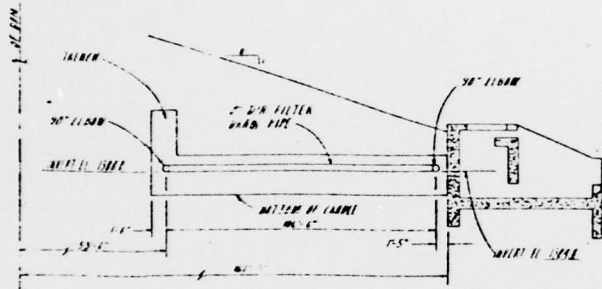
- 1 10" SECTION
- 1 10" SECTION
- 1 10" SECTION
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')

220'-0" TOTAL (USE STANDARD LAYOUTS) 1200'-0" TOTAL

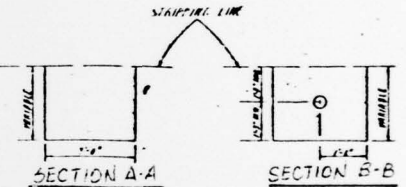
NOTE: ALL FILTER DRAIN PIPE TO BE 100' OR STEEL, CLASS II, SLOPE 1, LAYOUT TYPE A, A. A. A. A.

- 1 10" SECTION
- 1 10" SECTION
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')
- 1 10" SECTION (10' x 12')

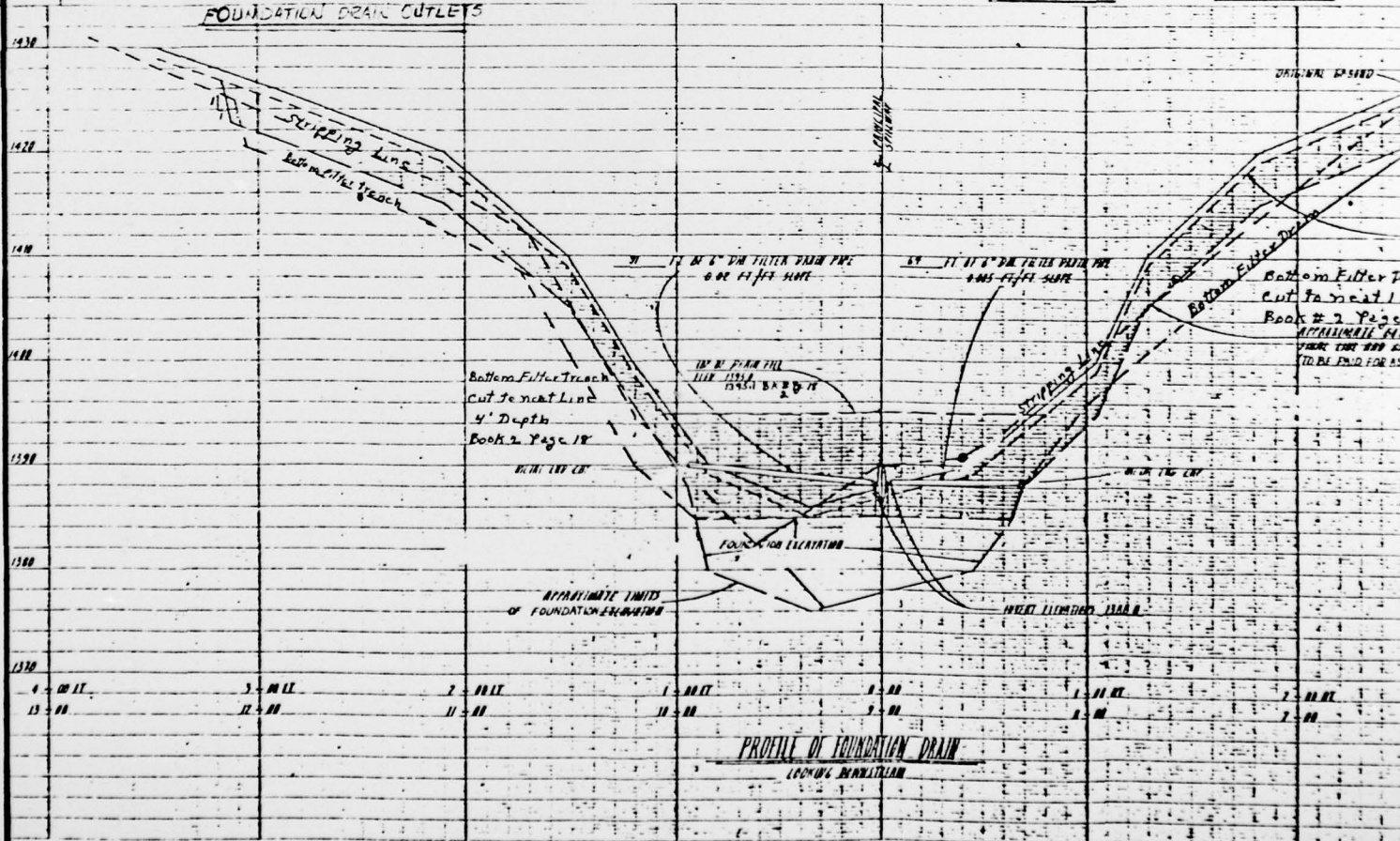
135'-0" TOTAL (USE STANDARD LAYOUTS)



PLAN VIEW OF FOUNDATION DRAIN NOT TO SCALE



FOUNDATION DRAIN OUTLETS



PROFILE OF FOUNDATION DRAIN LOOKING DOWNSTREAM

1	25 SECTIONS	
1	25 SECTIONS	
1	25 SECTIONS (5 LBS)	
1	25 SECTIONS (10 LBS)	
1	25 SECTIONS (15 LBS)	
1	25 SECTIONS (20 LBS)	
1	25 SECTIONS (25 LBS)	
1	25 SECTIONS (30 LBS)	
1	25 SECTIONS (35 LBS)	
1	25 SECTIONS (40 LBS)	
1	25 SECTIONS (45 LBS)	
1	25 SECTIONS (50 LBS)	
1	25 SECTIONS (55 LBS)	
1	25 SECTIONS (60 LBS)	
1	25 SECTIONS (65 LBS)	
1	25 SECTIONS (70 LBS)	
1	25 SECTIONS (75 LBS)	
1	25 SECTIONS (80 LBS)	
1	25 SECTIONS (85 LBS)	
1	25 SECTIONS (90 LBS)	
1	25 SECTIONS (95 LBS)	
1	25 SECTIONS (100 LBS)	
1	25 SECTIONS (105 LBS)	
1	25 SECTIONS (110 LBS)	
1	25 SECTIONS (115 LBS)	
1	25 SECTIONS (120 LBS)	
1	25 SECTIONS (125 LBS)	
1	25 SECTIONS (130 LBS)	
1	25 SECTIONS (135 LBS)	
1	25 SECTIONS (140 LBS)	
1	25 SECTIONS (145 LBS)	
1	25 SECTIONS (150 LBS)	
1	25 SECTIONS (155 LBS)	
1	25 SECTIONS (160 LBS)	
1	25 SECTIONS (165 LBS)	
1	25 SECTIONS (170 LBS)	
1	25 SECTIONS (175 LBS)	
1	25 SECTIONS (180 LBS)	
1	25 SECTIONS (185 LBS)	
1	25 SECTIONS (190 LBS)	
1	25 SECTIONS (195 LBS)	
1	25 SECTIONS (200 LBS)	
1	25 SECTIONS (205 LBS)	
1	25 SECTIONS (210 LBS)	
1	25 SECTIONS (215 LBS)	
1	25 SECTIONS (220 LBS)	
1	25 SECTIONS (225 LBS)	
1	25 SECTIONS (230 LBS)	
1	25 SECTIONS (235 LBS)	
1	25 SECTIONS (240 LBS)	
1	25 SECTIONS (245 LBS)	
1	25 SECTIONS (250 LBS)	
1	25 SECTIONS (255 LBS)	
1	25 SECTIONS (260 LBS)	
1	25 SECTIONS (265 LBS)	
1	25 SECTIONS (270 LBS)	
1	25 SECTIONS (275 LBS)	
1	25 SECTIONS (280 LBS)	
1	25 SECTIONS (285 LBS)	
1	25 SECTIONS (290 LBS)	
1	25 SECTIONS (295 LBS)	
1	25 SECTIONS (300 LBS)	
1	25 SECTIONS (305 LBS)	
1	25 SECTIONS (310 LBS)	
1	25 SECTIONS (315 LBS)	
1	25 SECTIONS (320 LBS)	
1	25 SECTIONS (325 LBS)	
1	25 SECTIONS (330 LBS)	
1	25 SECTIONS (335 LBS)	
1	25 SECTIONS (340 LBS)	
1	25 SECTIONS (345 LBS)	
1	25 SECTIONS (350 LBS)	
1	25 SECTIONS (355 LBS)	
1	25 SECTIONS (360 LBS)	
1	25 SECTIONS (365 LBS)	
1	25 SECTIONS (370 LBS)	
1	25 SECTIONS (375 LBS)	
1	25 SECTIONS (380 LBS)	
1	25 SECTIONS (385 LBS)	
1	25 SECTIONS (390 LBS)	
1	25 SECTIONS (395 LBS)	
1	25 SECTIONS (400 LBS)	
1	25 SECTIONS (405 LBS)	
1	25 SECTIONS (410 LBS)	
1	25 SECTIONS (415 LBS)	
1	25 SECTIONS (420 LBS)	
1	25 SECTIONS (425 LBS)	
1	25 SECTIONS (430 LBS)	
1	25 SECTIONS (435 LBS)	
1	25 SECTIONS (440 LBS)	
1	25 SECTIONS (445 LBS)	
1	25 SECTIONS (450 LBS)	
1	25 SECTIONS (455 LBS)	
1	25 SECTIONS (460 LBS)	
1	25 SECTIONS (465 LBS)	
1	25 SECTIONS (470 LBS)	
1	25 SECTIONS (475 LBS)	
1	25 SECTIONS (480 LBS)	
1	25 SECTIONS (485 LBS)	
1	25 SECTIONS (490 LBS)	
1	25 SECTIONS (495 LBS)	
1	25 SECTIONS (500 LBS)	
1	25 SECTIONS (505 LBS)	
1	25 SECTIONS (510 LBS)	
1	25 SECTIONS (515 LBS)	
1	25 SECTIONS (520 LBS)	
1	25 SECTIONS (525 LBS)	
1	25 SECTIONS (530 LBS)	
1	25 SECTIONS (535 LBS)	
1	25 SECTIONS (540 LBS)	
1	25 SECTIONS (545 LBS)	
1	25 SECTIONS (550 LBS)	
1	25 SECTIONS (555 LBS)	
1	25 SECTIONS (560 LBS)	
1	25 SECTIONS (565 LBS)	
1	25 SECTIONS (570 LBS)	
1	25 SECTIONS (575 LBS)	
1	25 SECTIONS (580 LBS)	

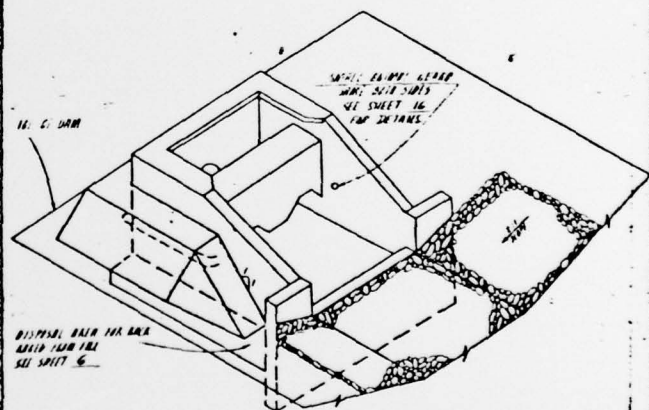
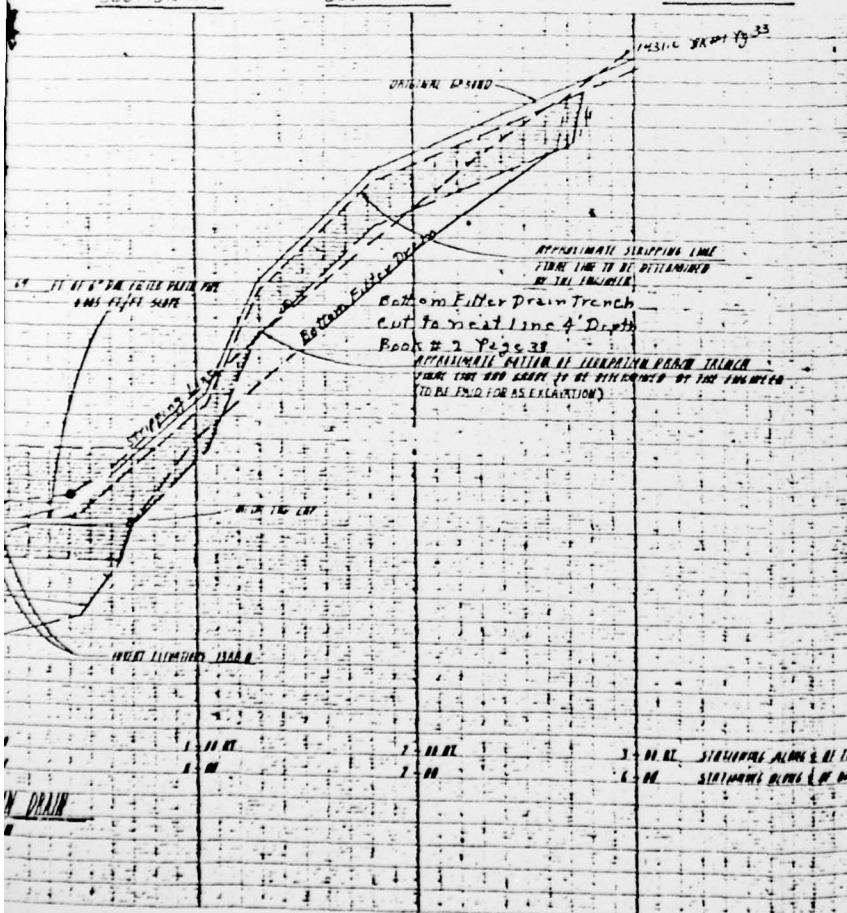
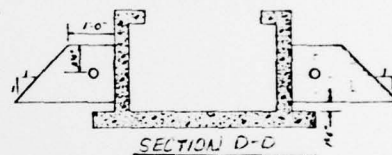
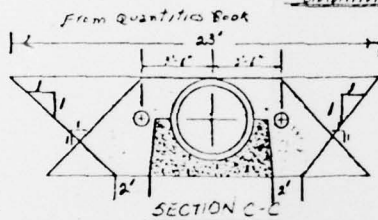
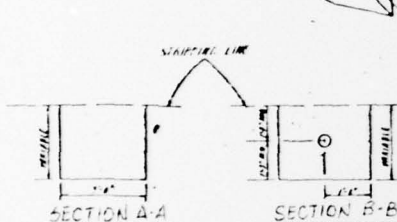
**HULL**

Part	No.	Dimensions
1"	100	
1/8"	81 - 90	
1"	75 - 80	
1/4"	75 - 81	
1/2"	62 - 75	
1/4"	55 - 70	
1/8"	42 - 50	
1/4"	31 - 44	
1/8"	18 - 23	
1/4"	8 - 12	
1/8"	4 - 5	

Scale: 1" = 10'

Notes: The hull is shown in cross-section, with the keel and various structural components labeled. The dimensions are given in feet and inches.

GRADATION LIMITS FOR DRAIN FILL (SPEC 105)



**FIGURE**  
ISOMETRIC OF FOUNDATION DRAIN OUTLET

## AS BUILT PLANS

MARSH CREEK WATERSHED  
MULTIPLE PURPOSE DAM PA-602  
TIOGA COUNTY, PENNSYLVANIA  
FOUNDATION DRAIN DETAILS

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed	Date	Approved By
<i>James A. Rothberger</i>	5-68	<i>[Signature]</i>
Drawn		Title
C. CRISE	5-68	
Trace		Title
Sheet	Drawing No.	
no. 7	PA-602-P	
of 22		
Checked		
<i>James A. Rothberger</i>	5-68	

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

APPENDIX F

GEOLOGY

### General Geology.

The Hamilton Lake Dam lies within the Glaciated Low Plateaus Section of the Appalachian Plateaus Physiographic Province. This area is characterized by broad anticlines and synclines and little, if any, faulting. There are no known faults in the vicinity of the dam.

The bedrock in this area consists of Devonian aged marine sediments. These consist of olive to gray colored siltstone and fine-grained sandstone with interbedded shale. The thin to flaggy bedding is usually well developed. The moderately to closely spaced joints are also well developed in a regular blocky or platy pattern. The rocks are not very resistant to weathering and must usually be excavated to sound material if they are to serve as a foundation for a heavy structure. The surface drainage is good while the joint and bedding planes provide a medium magnitude secondary porosity.



GEOLOGIC MAP OF HAMILTON DAM AREA



**Marine beds**

Gray to olive brown shales, graywackes, and sandstones, contains "Chernung" beds and "Portage" beds including Burket, Brallier, Harrell, and Trimmera Rock; Tully Limestone at base.

Scale: 1:250,000